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FROM INDIA TO RUSSIA IN 1914

Captain L. V. S. Blacker, Q.V.O. Corps of Guides

THIS is the record of a journey from Northern India *viâ* Central Asia to England. It traversed the same ground, to a great extent, as Dr. De Filippi's expedition, and I hope that these notes may be of interest in that they show things from a point of view different from his.

Leaving Srinagar on 14 June 1914, the first halt of my journey was at Leh, the capital of Ladakh, which was reached on the 26th, after a couple of days' delay due to a sprained ankle. This road is, of course, so well known as to need no further description. Having arrived at Leh, the business commenced of fitting out my modest caravan.

There was a great scarcity of men and ponies, as a result of Dr. De Filippi's expedition. I managed eventually to secure two passable ponies and three men. One of these was a youth named Karim, an Argoon, who proved most useful. Another was a Tibetan from Gyantse Dzong, named Puntsog, most uncivilized, but cheerful and willing; the third was a Turk named Sidiq. The latter was a disappointment; though he had served with Sven Hedin and received a Swedish silver medal from him, he possessed neither endurance, pluck, nor intelligence. I afterwards found that very few inhabitants of Central Asia had escaped becoming the recipients of this decoration.

Since no caravan had yet come through from Yarkand the ponies could not be hired but had to be purchased, and consequently all the details of fitting them out with saddlery, line gear, and grain had to be gone into at some length. My orderly, a Pathan named Ghulam Ali, proved exceedingly useful in the capacity of caravan Bashi. I was not able to start from Leh till July 6, but during my stay there received the utmost kindness and hospitality from every one.

The annual festival of the Tibetans, during which the celebrated devil dances take place in the monasteries, was then in progress. I was not able to go myself to the best known at Himis; but in Leh a minor "tamasha" took place, attended by the King of Ladakh, a British Commissioner, the missionaries, and all the notables of the district, including Subadar Nagdu, the Dogra officer then commanding the Maharajah of Kashmir's troops in the country. The Subadar as a Sepoy had gained

the Indian Order of Merit at the storming of Nilt Fort, during the brilliant little Hunza Nagar expedition of 1871, when he climbed the cliffs the night before the assault to reconnoitre the way up. He was one of those Dogra gentlemen whom it is always so pleasant to meet.

The proceedings commenced with a football match: the Army *versus* the rest of the World. The Army team consisted of Subadar Nagdu's Dogra and Punjabi gunners and myself. The other team was somewhat mixed, but included the Prime Minister as goal-keeper. As the field itself was heavy sand interspersed with boulders, and was 12,000 feet above the sea, the game was somewhat exhausting, but needless to say resulted in a victory, hands down, for the Army. The Prime Minister found it difficult to stop the excellent shooting of the Artillery Havildar playing for us. This was followed by a polo match of the true Central Asian type. The sides were Tibetans *versus* Mohammedans, and the game lacked nothing in dash; there were however no casualties.

The next day I set out and reached Ranbirpura, named after Maharajah Ranbir Sing. Instead of pursuing the usual caravan road for the Khardung or Laowchi La, I intended to trek up the Indus for two marches, and thence over the great Chang La, and along the left bank of the upper Shaiok. This track is to form a new caravan road from India to Central Asia. It was not so well known as the usual way by the Nubra River, but had recently been traversed by Dr. De Filippi's expedition.

In order to save the strength of the ponies, which I intended to take on into Turkestan, I had hired three or four additional local ponies which were to accompany me for the first six marches, that is as far as Shaiok village, the last human habitation, and were to return from there. I was very glad I had done this, as it led to my getting my ponies through without losing any, except one by drowning. This is most unusual; the caravans think nothing of the death of half their animals.

On the march up the Indus valley, which here is very wide, with great alluvial fans on both sides of the river, we passed several celebrated monasteries, notably those of Shay and Tikzay. The latter is in ordinary years a great storehouse of grain, and travellers can usually count on getting some thousands of pounds of barley (sattu). This year, however, Dr. De Filippi's expedition had rather strained its resources. These monasteries are all very well built of stone, and usually form the crown of prominent crags of rock.

The second stage was a village called Sukti, situated at the head of the side valley leading down towards Himis monastery, which forms the southern approach to the Chang La. I sent the baggage round by the ordinary road by the Indus, and myself went through the hills with Ghulam Ali and a Tibetan shikari in order to shoot some shapu. A great deal of the climbing proved fruitless, and crossing the Kilderma La we met the baggage as it was coming into Sukti. This is a small village of about twenty houses, with a grove of trees, in the middle of a somewhat

boggy valley strewn with great boulders. The hills on each side of the valley are of the usual precipitous Ladakh sandstone type. Here I met a Mohammedan merchant who had promised to supply me with the five pony-loads of barley that I needed to take my caravan through to Shahidulla; he was as good as his word, and courteous and helpful to boot.

Early next morning we pushed off up the valley, through a great mass of boulders, and struck a very decent path on the hillside. The valley-bottom held a surprising amount of grass, and even some barley. A steady pull took us up to a grazing-ground named Zingrul, where a side stream joined the main one. The altitude of this is some 17,000 feet above the sea, and progress from here onwards was beginning to become laborious. After a short halt the real ascent of Chang La began. This was by no means difficult, though the track lay among boulders, and the final part of the climb is by steep zigzags. It was a great relief to reach the summit, where there was remarkably little snow. I was under the impression that the Chang La was 19,600 feet in height; but I understand that Dr. De Filippi's survey has proved it to be somewhat less.

From Sukti I had commenced a prismatic compass traverse. I found considerable difference between the relative positions of Zingrul and the Chang La from those shown on the Indian Atlas Sheet. I found the magnetic bearing from Zingrul to the pass to be 45°; on the Indian Atlas Sheet it appears nearer 85°.

On the summit of the pass is a large chorten and two stone walls built by the Tibetans to resist General Zorawar Singh in 1848. The latter was one of the finest leaders in history, and served the Dogra Maharajah Gulab Singh of Jammu, whose descendants rule Kashmir, Baltistan, and Ladakh. It is important not to confuse his troops with the Sikhs, as is so often done. Dogras, being true Rajputs, do not advertise, and so, though second to none as soldiers, are not much known outside the Indian Army.

Zorawar Singh's expedition into and conquest of Baltistan and Ladakh are among the most marvellous feats of leadership that have ever been performed, and are very good instances of what Dogra soldiers are capable. The record reads like that of Cortes in Mexico. The walls themselves are a record of that curious inconsistency in fighting shown by the Tibetans, such as we had examples of in the action of Guru and the defence of Gyantse fort. Having built the walls after an expenditure of stupendous labour, the Tibetans omitted to defend them, being probably guided by astrological rather than strategical considerations. There is no doubt that when the Tibetan feels inclined he can put up an excellent fight; but at times he will walk away without striking a blow.

I had seen at Leh the mound from which Zorawar Singh had dealt out his brand of justice to the Tibetans, which seemed to consist mostly of boiling them in butter. He looted all the monasteries in Ladakh with the exception of that at Himis, which, being hidden away in a narrow side-valley, escaped his notice.

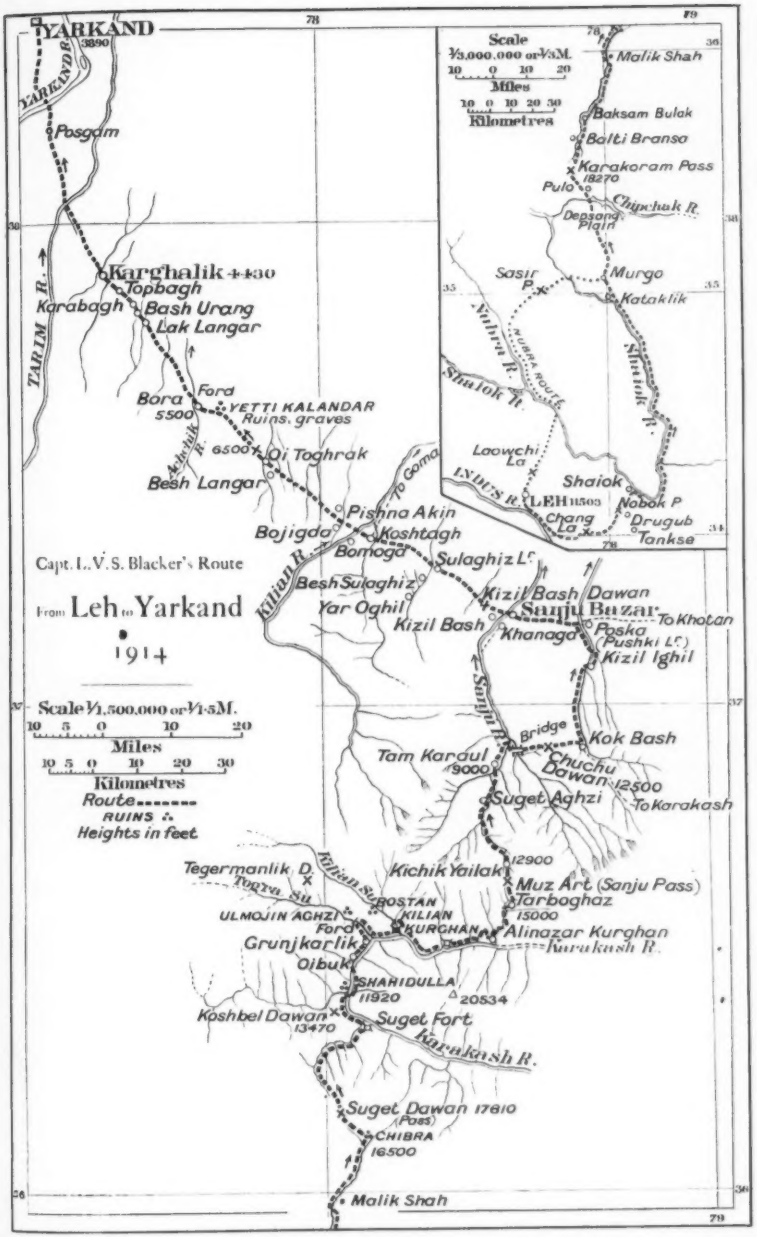
The descent from the summit of the Chang La to Tsul Tak took two hours, the first half-mile being over huge flat-topped boulders which caused me great anxiety about the ponies' legs. Tsul Tak is a sort of grassy Alp, with a lake some 300 yards long, and 100 yards broad in the centre of a wide valley. On the banks there was plenty of argl and burtse for fuel; the lake also held two geese; and they survived my efforts. I made the height of Tsul Tak to be 16,500 feet by aneroid. The march from Sukti occupied eight hours.

The next day's march took nine and a half hours for the ponies, but only six hours' ordinary walking. At first the descent was gradual, down a stream between granite hills, on the banks of which was a surprising amount of grass. The stream was everywhere fordable and the average descent 4° to 5°. After an hour and a half we climbed 500 feet up the right bank, on the flat top of a spur running north, mapped as Chigar Station. Here the river gets into an impassable cañon and grass disappears. Two hours from Tsul Tak the descent led down a steep rocky watercourse, and thence, skirting sandy salients, where the going began to be heavy, to the bridge of Drugub, shown as Durgu on the map, at altitude 13,400 feet. The bridge consisted of five 5-inch baulks, and was 20 feet long by 5 feet wide. The stream was, however, fordable.

From here we commenced a heavy ascent of 15°, deep in sand, the track winding along the hillside at 500 feet above the combined streams of Tankse and Drugub. The cliffs on the opposite side were vertical, but at their foot a track could be seen running down in the river-bed from Drugub village to a patch of barley about 200 yards by 50 yards, some 2 miles down from the junction. From Drugub bridge a goat track leads up westwards to the Nobok La. Two hours more of laborious travelling took us along a track which zigzagged up and down the cliffs, from level with the river to 1200 feet above it, in the gorge of the Tankse River where the heat was considerable. On both sides of the river the hills are impracticable, on the right bank being vertical cliffs.

Shaiok village (near the junction with the river of the same name) is the last human habitation till one has crossed the great ranges into China, ten weary marches further on. Here there were about two square miles of cultivation, mainly thin Tibetan "grim," and about twenty stone-built huts. There is also a new sardai for caravans. The camp overlooked the flat stony bed of the Shaiok river, more than a mile wide, with thickets of brushwood on both banks, affording an almost unlimited supply of fuel.

Next day the journey really began, in that we left all cultivation and human habitation behind us; from here, too, I sent back the ponies I had hired at Leh. The details of the caravan may be of interest. I had two riding-ponies, one for myself and one for Naik Ghulam Ali, both of which carried a good part of our kits. A spare pony carried my own 40-lb. tent, a second the food supplies for myself, together with a considerable quantity of tinsel and ornamental printed cotton fabrics and scarves, and also some


YARKAND
3890
YARKAND R.
Posgam
Karghalik 4430
Topbagh
Karabagh
Bash Urang
Lak Langar
TARIM R.
Bora
5500
Ford
YETTI KALANDAR
Ruins, graves
6500
Oi Toghrak
Besh Langar
To Goma
Pishna Akin
Bojigda
Koshtagh
Bomoga
Sulaghiz L.
Besh Sulaghiz
Yar Oghil
Kizil Bash
Kizil Bash Dawan
Sanju Bazar
To Khotan
Khanaga
Poska
(Pushki L.)
Kizil Ighil
Sanju R.
Bridge
Kok Bash
Tam Karaul
19000
Churchu Dawan 12500
Suget Aghzi
To Karakash
12900
Kichik Yailak
Muz Art (Sanju Pass)
Tarboghaz
15000
Alinazar Kurghan
Karakash R.
Tegermanlik D.
Toqtya Su
Kilian Su
BOSTAN KILIAN KURGHAN
ULMOJIN AGHZI
Ford
Grunjkarlik
Oibuk
SHARIDULLA
11920
20534
Koshbel Dawan
13470
Suget Fort
Karakash R.
Suget Dawan 17810
(Pass)
CHIBRA
16500
Malik Shah
Kilian R.
Capt. L. V. S. Blacker's Route
From Leh to Yarkand
1914
Scale 1/1,500,000 or 1·5 M.
Miles
Kilometres
Route
RUINS
Heights in feet
Scale
1/3,000,000 or 1/3 M.
Miles
Kilometres
Malik Shah
Baksam Bulak
Balti Bransa
Karakoram Pass
18270
Pulo
Chipchak R.
Depsang Plain
Sasir P.
Murgo
Kataklik
Yalung R.
Shyok R.
Laowchi La
INDUS R.
LEH 11503
Shaiok
Nobok P.
Chang La
Drugub
Tankse

toys, gaudy buttons, and knives destined as presents to the Kirghiz. These proved well worth taking, as the Kirghiz appreciated them tremendously; they were especially fond of mouth organs. The third pony carried rations and bedding for the men; the remaining five carried 1080 lbs. of barley that I had bought at Sukti. I calculated on having to carry barley at the rate of 6 pounds per pony for twenty days; this I hoped would give me a little in hand when I reached Shahidulla, where I hoped to be able to obtain more. The train was very modest for financial reasons; but I think if I were repeating the journey I should cut down everything still further.

The Lambardar of Tankse disappointed me, as he promised to provide sheep, and arrived on the morning of departure without the sheep but full of polite and plausible explanations. As a result of my reproaches he said he would come up the valley with me and show me a herd of shapu; accordingly he and I climbed about a great deal of hillside together, but the shapu were not forthcoming.

That day's march was a short one, taking five and a half hours for the transport. A stony descent at 8° led down from Shaiok in twenty minutes to a bridge over the Drugub River, immediately above where it meets the Shaiok River. The bridge was 30 feet long by 5 feet wide, constructed in the local semi-cantilever fashion supporting five 4-inch road bearers. The stream beneath it was constricted and torrential, and quite unfordable. The path approached the bridge in a sharp turn, but the exit was straight. From here we went through brushwood 5 or 6 feet high where there was some grazing. The hills to the south are only 200 or 300 feet above the river-bed, and less than 500 yards from the river.

After three-quarters of an hour from the village we passed a cairn of nine single stones, piled vertically, and climbed about 500 feet over spurs. The hillsides become very steep, especially on the north bank. Sirshak, the place where the men of Shaiok and Tankse graze their herds, is at the bend of the river, two and a half hours from Shaiok, from where the bearing to it is 185°. There is a small abandoned stone hut here, surrounded by ample grazing and fuel. A very difficult path leads hence over the hills to Tankse.

Half an hour later the track drops into the river-bed, and goes under 100-feet mud cliffs. After four hours one climbs by built-up zigzags up granite cliffs, the summit of which runs up to 1000 feet above the river. A little further on, on the opposite north bank, a huge mass of gigantic tumbled rocks comes down from the hills and forces the river round its foot into a sharp bend. Five very steep zigzags lead down to the river level to a camping-ground called Chang Jangal, meaning Big Forest. Here there is almost unlimited grazing and fuel for a small party, and good water from side streams, but the main river is very murky and unfit to drink; it is 100 yards wide here, and much too swift to be fordable. The hillsides are generally almost perpendicular and quite

impassable, and the altitude of the river is 12,800 feet. I made the bearing back to Sirshak to be 35° magnetic.

A circumstance that surprised me at Chang Jangal was that it rained a good deal when I was there, and it rained or snowed at intervals all the time during my march up the Shaiok, even as far as the Suget Pass. I cannot help thinking that the rainfall in this region is greater than in the remainder of Ladakh, where it is less than 4 inches per annum. There is in consequence more grass, of sorts, than in the other plains and valleys, where one can march for days without seeing a blade. When I say grass, I do not mean anything that is recognized as grass in Europe, but small patches of almost imperceptible dry vegetation that are best looked for with a magnifying glass, but from which the astonishing Yarkandi and Ladakhi ponies managed to get some nourishment. The Lanskar-bred ones were the toughest. I had only one Kashmiri, taken as a stopgap; he did not last very well and came to a violent end.

From Chang Jangal we marched to Dansir, which took eight and three-quarter hours. The track led up the eastern bank of the river, in its sandy but level bed, now from 500 yards to 800 yards wide, and flanked by almost perpendicular hillsides. About 3 miles from Chang Jangal we had to go a little way up the hillside to avoid a quicksand brought down by a rivulet. After two and three-quarter hours we reached the confluence of the Chang Chenmo River with the Shaiok, approaching it by a path built up over a cliff. At 100 yards above the mouth of the Chang Chenmo is an excellent bridge, 6 feet wide, built by the British Joint Commissioner, of willow baulks braced with wire. The river itself is narrowed in to 30 yards wide by dry stone walls, and in July was torrential and quite unfordable. The junction of the two valleys forms an open stony plain, and the river-bed is not as shown on the Italian Atlas Sheet, since the Chang Chenmo has apparently shifted some 2 miles lower down, and meets the Shaiok close under the hills, on the former's south or left bank.

Having crossed the Chang Chenmo, this track led for some miles over the bouldery plain of its valley, in which there was a good deal of brushwood and grass. This plain forms a dividing tongue between the two streams. After four hours' marching we came under the cliffs at the corner of the Shaiok and Chang Chenmo valleys. These are of yellow sandstone, portholed, and form a distinct landmark. On the opposite bank is more brushwood and grass. The path continues in the Shaiok bed, now slightly narrower. At six hours the river closes into the hills on the east side, and the track, here about 5 feet wide, is forced to ascend the cliff by built-up zigzags. After crossing a very small side stream, where there is a small patch of grass and some bushes, we descend again steeply into the river-bed an hour and a half later. At the foot of the descent is a small cave, with a spring near by, and enough fuel for a hundred men for one night; there is more fuel and grazing on the

opposite bank of the river, which, however, runs nearly 8 miles an hour, is 200 yards wide, and apparently very deep.

The spot that I understood to be Dansir is round a corner, under some mud cliffs, on a sandy fan. Here there is fuel for five hundred men, grass for a hundred animals, and ample space for a camp. I should have done better to push on for another hour and a half, where there is a good spot for a camp for a small party, with grass and fuel. However, I did not know of the existence of the latter, and so halted at Dansir. One of the annoyances of marching up this valley is that when coming to a patch of grass after six or seven hours' going, one does not know whether to stop there, or, in the attempt to put a good long march behind one, to go on in the hope of finding more grass. If one goes on darkness may come on before reaching the hoped-for spot. If one does not know the road the finding of a patch of grass is a matter of luck, and if the animals spend a night without grass it will undermine their strength enormously and cause casualties later on.

The lower slopes of the hills began to be less steep, and from here onwards both the valley of the Shaiok itself and the side valleys became gradually more open and traversable till one reaches the Depsang plain itself.

From Dansir 12° zigzags led up over the cliff, and the ascent to 13,900 feet took forty minutes. From here one gets an excellent view of several snowy peaks and patches of grass, with the river 500 feet below and 150 yards wide. One hour on from Dansir is a spur, and a little further on one descends into a nullah, by a path sloping 80°. A quarter of an hour later is a torrent 10 feet wide and an ascent on to the high bank of the Shaiok by several 25° zigzags. At eighty minutes is a white pillar rock. The slopes of the hills to the east are easy, and the track crosses the foot of them. A little further on, 100 yards to the west of the track is a yellow crag, about 100 feet in height. Five minutes beyond this is the camping-ground mentioned in the last march, where there is grass for about a hundred animals and plenty of fuel and good water, also the remains of a bransa, or stone shelter. After this an ascent of 20° took us to the top of a curious yellow spur covered with conspicuous black patches. The top was reached at an hour and three-quarters from Dansir, and from here four snowy peaks were visible.

Steep zigzags led down 300-feet cliffs to the crossing of a stream 20 yards wide, 13,400 feet by aneroid. After crossing the stream we had to ford a side channel of the Shaiok twice, diagonally; this was more than 3 feet deep, but the current here was less than 4 miles per hour, as the channel was a sort of backwater under the cliff. The track thence lay in a stony river-bed, and then over a ridge. From the top of the ridge was a high waterfall, on the west bank, bearing 295°. A little further on was some brushwood and grazing, and more on the opposite bank. The river-bed had gradually opened out to a width of 600 yards, and the

hillsides were getting gradually but distinctly easier. At two and three-quarter hours the path was built into a cliff, several minor streams were crossed, and there were at intervals patches of grass and fuel. The road was sometimes on the edge of the 150-feet cliffs, sometimes in the river-bed. I decided to camp where there was good grazing and fuel, after eight and a half hours' marching, at 13,900 feet.

The next day's march was a short one of five and three-quarter hours, and of very much the same character. After three hours and a quarter was a good patch of grass, close by a three-humped hillock. Ten minutes further on one lost sight of the river, ascending at about 20° over two gentle cols to 14,350 feet. A further ascent to 14,950 feet was reached at four and a half hours. The river was here again in sight, with a rocky island in the centre of it about 800 yards long and rather conspicuous, since though the river now begins to hold many islands, the rest are all flat and sandy. Camp was reached at five and three-quarter hours at 14,800 feet, in an open valley out of sight of the river. This was on a pleasant grassy slope, which I estimated at sufficient for one thousand ponies. There was also ample fuel and water here. Again I had some difficulty in deciding whether to push on in the hope of finding more grass, or to stay where we were. It was a pleasant camp, and there were several pigeons there. I had hoped to find burhel all up the Shaiok, but not a single one of any kind came in sight, though I saw plenty of skeletons and heads. Karim told me that this was quite different from other years, though the explanation did not help the commissariat. To stave off famine I had to stalk pigeons with a ·22 bore rifle. This was most anxious work, as the food supply for a day often depended on the result of a single shot.

The next day's journey took us to Kataklik in twelve and a quarter hours. This is not the Kataklik shown on the survey sheet, but in the mouth of the next side valley to the south. These place-names are nebulous, and are merely those allotted by the merchants' custom to vague and ill-defined halting grounds. I found the spot rather hard to identify from the map, as these old sheets are weak in hill features—in fact, the hachuring does nothing to indicate the shape of the ground.

Shortly after starting we crossed a stream 8 feet wide, 14,700 feet, at the bottom of a deep gorge. At forty-five minutes a slight ascent led over a small col, the back bearing to the camp being 135° magnetic. The ground here was covered with a saline efflorescence. The river continued to be out of sight. The next valley held a rough stone shelter, and some very poor grazing. The lower slopes of the hills are quite open. After climbing steadily to 15,200 feet another col was crossed at one hour ten minutes, the back bearing to the camp being 152°. A few minutes further on was another small open valley, with a pond of about 80 square yards in the centre. A rise of 3° to 4° took us to a patch of quite green grass 200 yards by 20 yards at one hour thirty minutes. This would have formed an excellent place to camp at instead of the night before, thereby

shortening the march to Kataklik. There is another pond a few hundred yards further on, and a dry pond at one hour fifty minutes. Shortly afterwards the road comes to the edge of a precipitous ravine running into the Shaiok (15,400 feet). The track leads down at 14°, amongst big boulders. The last 200 feet of the descent are through heavy sand. The bed of the Shaiok was reached at two hours fifty minutes (14,600 feet). The river is about 600 yards wide, the bed over a mile wide. At the mouth of the gorge there is fuel for two hundred men. Very soon the path climbs up on to the edge of some cliffs; here the going is very bad indeed, with many ups and downs through tumbled boulders. After an hour and a quarter of this the path turns a corner into a side nullah, shown incorrectly on Sheet 44A, but correctly on Dr. Longstaff's map. Sharp zigzags took us down 250 feet, and from there along the left bank of a tributary 50 yards wide. About a mile up is an excellent bridge, 20 yards long and 10 feet wide, with three 5-inch baulks stayed with wire. The exit is rather steep (12°) over a cliff. The path re-enters the Shaiok valley at five and a quarter hours. From here onwards there are frequent patches of fuel. At six hours fifty-five minutes, we climbed over a grey rocky spur; ten minutes further on the track was carried away by a landslide, and it was necessary to make a detour through the side channels of the Shaiok. It took a long time to find the fiords, and we were delayed about an hour. Big glaciers are visible from here on the west bank, also some bright red hills near Kataklik, on a bearing of 355° magnetic.

Twenty-five minutes further on the path, having been high up on the side of the hills, descends 150 feet into the precipitous gorge of a side stream by a 25° slope. The going is bad from here onwards, sometimes in the river, sometimes over the foot of the hillsides. The mouth of the Kataklik nullah was crossed after ten hours forty minutes' marching, and passing a black knoll in the mouth of the nullah we turned up its right bank. A 300-feet climb over a spur showed us the camp 100 feet below at eleven and a quarter hours (15,300 feet). Here there is ample grazing. This place was very difficult to identify from the map, principally owing to the fact that the hill features are very roughly put in. It must be understood that these halting-grounds have merely names given by the caravan people, but I had no doubt that where I had camped was the real Kataklik. The names are not Tibetan but Turki, since, though the country is Tibetan, the majority of the people that travel the roads are Turkoman.

When in Srinagar I had access to the maps published by Sven Hedin of his 1906 journey into Central Asia. These had been most beautifully lithographed by the Swedish General Staff at Stockholm, and I took a lot of trouble to make tracings of them for my own use; however, after two or three days' marching from Leh I recognized that the lithography was far in advance of the topography in them, so I packed them away and regretted the loss of the time I had spent in copying them.

The next day's march to Murgo was short and troublesome. Turning our backs on the Shaiok valley a gentle ascent took us up a pebbly water-course, very level and open and with easy hills on either hand. Just after leaving camp we saw fresh camel tracks, which of course proves that camels can get through the whole way, for since there are no camels in Ladakh, the animals that made the tracks must have come over from the Chinese side, and therefore, since they had got as far as Murgo, I saw nothing to prevent them getting to Leh. I think the Chang La could certainly be traversed by camel transport, and if they could get to Leh they could also get to India. Of course these remarks refer to the Central Asian Bactrian camel: the ordinary Indian camel of the plains would not survive the cold and the rigours of the journey.

An hour and a quarter took us up to 15,550 feet, where there were several heads and bones of burhel. Round a corner down into a very steep gorge by a sandy zigzag path of 25°, a descent of 350 feet took us down to the stream. The precipitous opposite side of the gorge was of brightly coloured yellow and red and blue rocks. The stream was 10 feet wide and swift. The ascent also of 350 feet was steep (20°) and heavy going. The path gently ascended the side of the hill, and a side nullah is crossed at two hours forty minutes at 15,950 feet. Here is grass for five animals. The hillsides again become open, and the path turns the corner at two hours fifty minutes, where there is a huge chocolate-coloured rock. The Shaiok again becomes visible, some more coloured hills bearing 298° magnetic, and river confluences at 192°, 215°, 275° respectively. A purple hillock bears 311°. The path descends across a pebbly open hillside and two shallow watercourses, each containing fuel. At four hours thirty-five minutes we turned up into the Murgo Gorge, descending into the bed (15,000 feet) by stony zigzags. We crossed the stream and over a spur on the right bank at four hours forty minutes. A 50° descent took us into the bed again, where the red stream joins the bright yellow one. After fording the red stream we got into the narrow gorge, and the trouble commenced. Coming round the corner I met one Ahmed Akhun, who was bringing up supplies for Dr. De Filippi and had been stopped by the river. He said that two Mecca pilgrims had been drowned trying to cross with their camel just before. Crossing the stream again with a certain amount of difficulty, we scrambled along the rocks at the foot of the cliff to an unpromising-looking place where the path stopped and began again on the opposite bank. The river was about 20 yards wide, quite 4 feet deep, and coming down very hard. Ahmed Akhun explained that this was the difficult place. I was determined to get across, as I did not think matters would be improved by waiting for the river to go down, in view of the rain that had fallen. I accordingly had all the ponies unloaded, and while we were doing this the tail of the caravan came up, including Puntsog, looking very bedraggled and sorry for himself. He, or rather Karim, explained that he had been swept off his feet in the river and

carried a long way down on to a handy sandbank, from which he had been rescued, after losing my lamp which he was carrying. I took the two strongest ponies, and, taking all unnecessary gear off them, I mounted Ahmed Ahkun on one and myself on the other; and putting loading ropes round us with a bowline, I told the men to hang on to the other ends of them whatever happened, and just managed to get across, the two ponies supporting each other in the water. There was nothing to spare, and I had grave doubts about getting loaded ponies across. Fastening one baggage rope to a sharp rock on my side, I made Karim do the same on his side of the river. I fitted a stirrup to act as the runner on this rope, and two more ropes to haul this backwards and forwards. A loaded pony then had his bridle lashed to the stirrup leather, and was hauled across after losing his feet once or twice. It took about two hours to ferry all the ponies in loads across in this manner, the only mishap being when Ghulam Ali came across. The stirrup leather in some way became unbuckled and he and his pony were swept down, but by some miracle they got jammed between a pinnacle of rock and the cliff on the right side of the river. We had not much difficulty in getting ropes down to them and hauling them up again.

A little further on there was another crossing of the same kind, which proved no easier. Sidiq's courage began to desert him, and he announced that he "was not for crossing any more rivers." I had to point out to him with some hard words that if he did not cross the river again he would have to spend the rest of his life on the little heap of boulders where we then were. We repeated the procedure, which took quite another two hours, everything getting thoroughly wet by being hauled under water, but the ferry was finished. However, when all the loads were over, the ropes remained with the far end tied to the opposite bank; as we could not spare these ropes I had myself lowered down the rope and unhooked them on the far bank, and placing the loops over one shoulder and the other arm, was hauled by brute force across the stream, again mostly under water. The force of the water was so great that it took four men on the rope to make any progress.

After this the gorge opened out, and the crossing of the stream, which had to be repeated a good many times, was quite easy. After seven and three-quarter hours' very wet marching we reached a patch of grass under some mud cliffs, which I understood was Murgo. There was grazing here for fifty animals and a little fuel. Here the track joins that coming over the Sasir Pass, the more usual route to the Karakoram. I think that if there had been any more water coming down the stream, it would have been impossible to cross it, even on camels, without using wire rope. A bridge is distinctly needed here.

The next day's march was the first on the ordinary caravan road. This was obvious from the great numbers of skeletons that we began to see lying along the track. The latter leads up a narrow rocky valley, the hillsides are bare and very steep, and the river runs in a gorge. This is

crossed twice at one hour; then the hillside to the south-east is ascended by zigzags, the top of the ascent being 16,200 feet. The descent is at first gradual, but at two and a quarter hours becomes steeper, with more zigzags. The river, 15,600 feet, is crossed again at two hours thirty-five minutes. Here the alternative track zigzags over a very steep and rough spur up to about 2000 feet. Five minutes further on a natural bridge of boulders is crossed. At three hours the river-bed opens out, and after continually fording channels to the stream, Kizil Langar (Red resting-place) is reached, after nine hours' marching. Halfway there was grass for twenty animals; the spot is, I believe, called Burtsa Chung Bransa, or "the shelter where there is much grass." Another spot is called Burtsa Kichik Bransa, or "the shelter where there is little grazing." Here there was no grass at all. The hillsides now are very much more open, and the valleys are wider; in fact, one again becomes conscious of having a skyline, since there are no great hills towering round. This is not to be wondered at, since it would need a very big hill to look down on 17,000 feet. Some of the hills around are steep, although quite practicable, and the colouring was generally bright.

On this march we met two caravans and several parties of pilgrims—the first human beings we had seen for some time. They were very Central Asian, and several of the pilgrims were women, some of them Kirghiz, wearing the quaint, white, towering headgear that reminds one of pictures of Edward the Third's Court. The men's boots were the most noticeable thing about them, being made of soft leather reaching above the knee, the foot part being made separately, like a stout shoe, so that it can be slipped on and off. This is to conform with the oriental custom of removing one's footgear when stepping on to a carpet; the man slips off the outer shoes, and retains the long soft leather boot. The women wore these boots too; they are practically universal throughout Central Asia.

Another curious feature was the men's hats, made of felt, of the colour and shape of the top of a mushroom, and sometimes bound with black braid. I judge that these were made in Khotan, where there is a considerable felt industry. This was also evidenced in the loads of the caravans, every pony having several felts just over his saddle, acting as pannels on the journey, and destined for the Indian market. These were often of bright colours, orange and purple predominating, and were used as bedding by the merchants in their camps when halting. I cannot help suspecting the use of German aniline dyes, the more so as I remembered seeing, some years before at a Tibetan festival at Kharbu in Ladakh, women wearing sheepskins covered on the outside with bright-coloured cloth embroidered in huge yellow letters "Made in Germany."

The next stage was to a camp on the Depsang plain. A gentle ascent, at first up a narrow ravine, took us in three hours across a spot marked as a pass on the map, on the great Depsang plain (17,800 feet). For an hour and three-quarters on we marched over undulations and watercourses,

almost level the whole way, till we found Dr. De Filippi's base camp in a larger nullah. The Depsang itself is of about the contour of Salisbury Plain, but quite bare, and has a marvellous surrounding of mountains. Here I met the Marquis Ginori and Prof. Alessandri, who entertained me hospitably and showed me all their splendid equipment of instruments. The Doctor's party were then absent on the Remo glacier, and Major Wood's in the unexplored valleys to the north-west of the Karakoram.

The Marquis Ginori told me a very interesting thing about the meteorological pilot balloons that they sent up—that the rate of ascent at the Depsang was considerably greater than at sea-level. One of these balloons, released at Leh, had descended in Rudok and had been the subject of a special commission of investigation from Lhasa; it was supposed to portend great events.

There was no grass or fuel here, but good and ample water. The track, as far as the eye could reach, was marked out by a double line of skeletons, a few of which were those of camels, which confirmed the deduction that I had made at Kataklik.

Starting late the next day we crossed the River Chipchak at one and a half hours, where there was a little grass. From here to the eastwards there is a possible track to the Lingzithang, up which Dr. De Filippi's geologists had gone. The country is all very open here, and going up the valley we passed three ruined huts called Pulo, which are just on the opposite side of the spur to that shown on the map. Camp was reached (17,900 feet) in nine and a half hours. There was no grass or wood, but good water. Just before coming into camp I shot a tsos, which greatly relieved the shortage of rations. We all had a hearty meal that night, and felt better for it. Now one really felt that one was on the roof of the world, but the only one who suffered from the great altitude was Ghulam Ali.

Below Pulo is Daulat Beg-uldi, or "the place where Daulat Beg died." Daulat Beg was the nickname of Sultan Shah, one of the Turkoman invaders of India, who met his end here when returning from one of his incursions, as a result of the great altitude, probably accentuated by Indian capuas. "Uldi" is a grim suffix to many Central Asian place-names. It is strange to think that his men's descendants have been fighting in Flanders.

The next day a gentle ascent of about half an hour took us to the foot of the Karakoram Pass itself, where I shot another gazelle. The actual ascent to the pass is only 300 feet, and not very steep. There is an excellent view from the summit, and it is obvious that the Survey Sheet is wrong in the shape of the hills. I saw no sign of the Chinese board marking the supposed boundary on the top, and what I took to be the monument to Mr. Dalgleish, who was murdered by the Pathan Dad Mahomed, is a little way down the other side, and looks like a pile of

ordinary stones. There is a short and not very steep descent that takes one down to a broad, open, shingly valley, and a patch of grass on the right bank of the stream is passed after six hours' marching; this is called Balti Bransa. The shape of the hills to the west gives one the impression that there is another valley in that direction, running parallel to the one we were in, which latter contains the headwaters of the Yarkand River. An hour and a half further on is a level plain called Baksam Bulak, where there is a good patch of grass, but no fuel. A big valley joins in here from the west. Here there were several more gazelle, but too small to shoot. Seven and three-quarter hours took us on the next day to Malik Shah. A place called Wahab Jilga, where there is no grass, was passed at three hours. We got several glimpses of the great undulating Kara-tagh (Black Mountain) to the east.

At Malik Shah there is a little very thin grass, and the track diverges to Ak-tagh (White Mountain). From here a miserable march through alternate snow and rain, in open valleys, led us at six hours to the Suget Pass (17,610 feet). This was reached by a gentle ascent, and a steep descent took us down to a patch of grass one and a half hours further on, called Kotaz Jilga (Yak Valley). Chibra is a ruined stone shelter about 3 miles short of the pass. I should have done better to push on a bit, and would have found better grazing. The next march led down an easy descent, past patches of good grass, and through a very stony landslide. Steadily descending, the path led round great spurs of the hills. Five and a half hours saw us in sight of the fort of Suget. The background to this was the imposing mass of the Karanghu range, crowned by many 20,000-feet peaks. The valley became much more grassy and full of brushwood, though steeper.

The fort, which is at the river junction (not as shown on the map), is reached at six hours and three-quarters. Here we seemed to have come back to the world again. Even barley is grown here, and there is ample grass. The fort is a square mud and stone enclosure, not loopholed, but without flank defence; the notched walls are about 7 feet high, there is no ditch, and it is commanded as to rifle-fire from spurs to the south-west. This is the real Indo-Chinese frontier: not, as is so often thought, the summit of the Karakorum. In fact, this same fort used to be garrisoned by the troops of the Maharajah of Kashmir, and was several times attacked, even as late as the nineties, by Kanjuti raiders.

Here there was a Chinese official (Ssu-yeh), a young man who had not altered his ways in consequence of the revolution. He wore the old blue silk habit, a pigtail, and long finger-nails. He was most obliging, and supplied me with 420 lbs. of barley and as much flour as I wanted for 27 rupees in Indian money. He was very pleased to be given some cigarettes and preserved ginger. Some Kirghiz, under a Yuz Bashi (headman of a hundred), called Musabai, were there too with some camels. Musabai came on with me the next day with four camels to show me the road

and the fords through the Karakash. The valley-floor is flat and stony, but the hills of the Karanghu-tagh tower up almost vertically to enormous heights. The path led us through the side of the Karakash River, where the ponies had to swim round a shoulder of rock. The camels, which were carrying their loads, could just keep their feet. This was opposite Shahidulla, where there is an old ruined fort at the mouth of a steep and gloomy-sided valley. This used to be held by the Chinese when the Dogras held Suget fort. Here also there are a few Kirghiz huts and a Mohammedan ziarat (shrine), which however looks very like a Buddhist chorten; it probably fills both rôles, like wayside shrines in India.

After crossing the main channel of the Karakash again we were brought to a halt by the Togra Su (straight river), coming down with great force and quite impassable. Following its right bank for about 1½ mile, where is the usual ford, we met a merchant named Rahman, camped there with his caravan. He explained that he had been waiting a fortnight to cross, which did not sound very cheerful. I spent the afternoon in getting the shoeing of the ponies completed by Musabai's young men, who were real experts. I had had to reshoe some of them at Malik Shah, and Sidiq proving incompetent, had to do it myself, so I was glad to get them all properly shod here. Musabai himself was splendidly mounted on a Karashar Mongol pony, which went at an amble or triple at a great speed. He had a fine silver-mounted bridle, saddle, and stirrups, soft brown leather boots, a tall peaked cap edged with fur, and a long robe of many colours. His kit consisted of a bright orange-coloured piece of felt rolled behind a saddle, and a metal cooking-pot. The outfit was completed with a silver-mounted Badhakshani whip.

Since the Togra Su was glacier fed I hoped that the water would subside in the morning. This came to pass, but not till 11 a.m. The fording had to be done diagonally across a couple of islands, the camels carrying the baggage. We crossed on the riding-ponies, the baggage animals following in our tracks, though all had considerable difficulty in keeping their footing against the force of the current, and the only Kashmiri pony I had, straying a little away from the proper ford, was swept away like a flash; after about two minutes his nose appeared some 300 yards down in the seething waters, and that was the last we saw of him. Another pony foolishly followed him, but did not get quite so far into the torrent, and just managed to scramble ashore lower down, helped by Rahman's men. Just above the ford is a ruined village called Bostan, with a little barley sown around.

The next march took us, after crossing the Kilian-Su near an abandoned fort (Kilian Kurghan), to a place called Pile-toghack. The track ran up the left bank of the Kilian-Su to the Kilian Pass. I discussed the question of going up this with Musabai; he said it would be very difficult to cross the stream higher up at that time of year. It would have been possible to reach Yarkand by this route, though far from easy. Pillata

Gash is a square, fort-like enclosure with high mud walls and rooms inside, owned by a Taghlik (hillman) who cultivated a little barley here and owned some herds of goats. Just before reaching Pillata Gash we had another awkward passage through the edge of the Karakash. The valley had narrowed in, and the path led on to the face of a cliff. The river was here the most violent stream I have ever seen. It closed in to about a hundred yards wide, roaring between the cliffs so that conversation had to be done in shouts. Here all the loads had to be man-handled over the cliffs, and Musabai's men were beyond praise. The camels had been sent back, and the ponies, supported by ropes, went along the path through the rushing water, which towards the end reached nearly up to their withers; however, we got through without any casualties, and were tired enough to be pleased to halt at Pile-toghack.

From here a short march of three hours took us to Ali-nazar-kurghan. To reach this, we again had to man-handle the loads over the cliff face, where the ponies could not get through the water and had to be sent unladen over a very steep spur and down the other side. The path was so steep that I do not think they could have carried loads up it. The halting-ground is half a mile on from this, and is marked by another quite big ziarat and graveyard. Here there were piled a great number of horns which appeared to be small *Ovis poli*. Musabai went back from here. I gave him thirteen rupees, with some small mirrors and gold-embroidered cloth which pleased him greatly.

We had subsisted so far on "kulchas," a sort of biscuit which I had got made at Leh. These were very satisfactory, but had all got damp in the many river crossings, so we laid them all out to dry in the sun. From here we abandoned the Karakash Valley, which appears to become very narrow and precipitous to the north-east. Climbing up the river-bed of the side valley, at three-quarters of an hour we came to a meeting of the streams. The track to follow is that to the right, or east. A little further on is another valley junction; here keep to the left, or west branch. The nullah becomes steep and stony, and the sides precipitous and vertical. Tarboghaz—also a valley junction—was reached at five hours, after a stiffish climb. Here camping in a sort of cave I met two Hindu merchants, who, retiring from business in Turkistan, were going back to India with their savings and the small son of one of them. They were effusively polite, and seemed very pleased to meet a sahib. That night and the next morning it snowed heavily.

The Khirghiz Beg had sent yaks to take my baggage over the Sanju Pass. We started early in the morning, through heavy snow, and up a very steep gully. A heavy climb of two hours took us to the summit, which is a knife edge (17,600 feet). The snow suddenly stopped, and we got a magnificent view of the unknown mountains to the east. All the hillsides here seem very steep, but I could see no trace of the glacier which is reputed to exist on the top of this pass.

A correspondingly steep descent of an hour and a quarter took us to the open, grassy pamir of Kichik-yailak. After an hour's march over undulations where marmots abounded, I caught sight of a white European tent close by a large encampment of Kirghiz, and found here a Russian soldier, presumably a Cossack, who explained that he had come from Prjevalsk, a cantonment on the shores of Issik Kul in Semirachensk, a good many hundred miles away, over intervening mountains and deserts. He was accompanied by three Kalmuks and five horses, which were being shod. He seemed a most enlightened fellow for a private soldier, being able to point out the regions he had traversed on an English map. He was interested to see my photographs and also in Ghulam Ali—a brother in arms had we only known it. He explained he had come to shoot marmots.

The Khirghiz brought me an excellent supply of curds, and also some magnificent butter in a lordly dish, which was very welcome after the weeks we had spent without it. The Beg was a man of over seventy, with a long grey beard. He remembered Sir Robert Forsythe's Mission to Yakub Khan in 1873, with its escort of Guides cavalry. I was very interested to hear about all this, especially as my regiment is the only part of His Majesty's Forces that has served in Central Asia. He had too stories of Kanjuti raiders, and told me the tale of the band that perished on a great glacier in the heart of the Karakoram ranges.

I inquired by what name the Sanju Pass went locally, and was told Jandar Art or Grim Dawan or Muz Art. No one calls it the Sanju Dawan, except the maps.

Descending from the pass the track led along the upper waters in a narrow valley. Here there is grass nearly everywhere, and lower down some patches of cultivation, with an empty hut or two. Tam-karaul is a farm, similar to that at Pile-taghack, reached after a rather short march. The next morning, pushing down the valley for about an hour, we turned up a side nullah to the eastwards. It is sometimes possible to reach Sanju village by going straight on down the Sanju River, but at this time, I was told, there was too much water, and I had to make a *détour* over the Chuchu Dawan. After turning east a short but steep climb took us over a spur, the north end of which forces the river into the gorge. We then crossed the river by a very fairly good wooden bridge about 30 yards long, and pushed on high up a hillside on the east side of a steep valley. The path very soon got into the watercourse, and for a good many miles is shut in by walls of black rock, winding interminably upwards. A steep climb took us over the pass (14,500 feet), and a zigzag descent the other side led down into a narrow grassy valley; the rivulet in this is brackish and unfit to drink. Six and three-quarter hours' marching saw us at Kök-bash (blue head), a farm owned by one Yakub, a Taghlik. Here there was a little cultivation where the two big valleys joined. A path led south-eastwards, and Yakub told me that this led over a pass, about one and a

half marches up the valley, presumably into the great gorge of the Karakash River. Here some of the ponies showed sore backs, which I treated by applying a mixture of equal parts of iodoform and boracic acid, which gave the most excellent results. Luckily, the loads having been nearly all consumed, I was able to relieve of their saddles those animals that were at all bad.

The next day a long march of ten and a half hours, in considerable heat, took us down an open rocky valley leading northwards, past a hamlet called Kizil Ighil at about halfway. Here there were trees, grass, and cultivation, and several families. Going steadily downhill, and with the temperature regularly increasing, we came in sight of an oasis called Posta, or Postaki Langar, with a big area of cultivation and many trees and houses; but we left this about a mile on our right to the east, and quitting the valley climbed over some big sandhills to the Kizil Bash Dawan (Red Head Pass). About 300 feet ascent and heavy going took us on to the sandhills, which here form the border of the Taklamakan Desert.

We reached Sanju after dark, and camped in an orchard belonging to one of the principal inhabitants. Sanju is the first big village, and is quite a trade centre, having a bazaar with twenty shops. The cultivation stretches up the valley for about 2 miles. There are many trees in the oasis, which is celebrated for its fruit. All the inhabitants are most hospitable, and seemed very pleased to meet strangers. When I had settled down into camp my orderly announced that two ladies had come to call; these, however, turned out to be the two Chinese officials, whose straw hats and pigtails, long robes, and smooth faces had deceived Ghulam Ali. They saw my passport, and very politely inquired what they could do to help me.

Nine and three-quarter hours' hot marching over the desert, amid endless sandhills, took us on from here to Koshtagh, an oasis like that at Sanju, but smaller. Oi Toghrak was reached the next day, after a similar march of eight and three-quarter hours. From here to Bora was five hours. All these marches are almost exactly the same, through gravelly and sandy desert scenery, the road running generally east and west. To the south the mountains can be seen in the distance, and to the right nothing but desert. The villages are each in watercourses flowing from south to north across the direction of the march. Where there is water the cultivation is extremely fertile owing to the careful irrigation, and this makes an astonishing contrast in the day's march. The inhabitants are all very courteous and hospitable to strangers, willingly lending their orchards to camp in, and producing all sorts of supplies and fruit. It was even at times a matter of difficulty to get them to accept payment, and they preferred presents in kind to money.

Karghalik was reached the next day. This is a town where there is a Chinese district magistrate, troops, and police. The population of the

towns are called Alti-Sharliks (people of the six cities). They form a section of the population distinct from the Taghliks (men of the hills), such as I had met at Tam-karaul and Kok-bash. These are also cultivators, but more bucolic and hardy. The third division are the Kirghiz, who are entirely nomads, living in tents on the produce of their yaks, camels, horses, and cattle. They have little or no cultivation, and are governed by their Begs, Ming Bashis, and Yuz Bashis. The Kirghiz seem to merge into the Cossack on the Russian side, and to give way to the Kalmuk on the Mongolian border. The Alti-sharliks are nowadays soft and peaceful, and fail to recall the swashbuckling Turkoman of the Middle Ages, or even of the days of Skobeleff and Yakub Khan.

At Karghalik there is an Aksakal (white beard), an official appointed by Sir George Macartney to look after trade to India, and the Aksakals at every town I came to spared no pains whatever to do everything they could for me. The one at Karghalik had a room ready in his sarai, with carpets and felts, and unlimited quantities of fruit, tea and sweets. He also had some Chinese visiting-cards painted for me, and equipped with these I called on the Amban.

It is most important in dealing with Chinese officers to pay attention to their etiquette. I had with me some white review-order uniform, well starched and carefully packed. Having sent a card on ahead about half an hour before, I donned this uniform, and accompanied by the Aksakal and by Ghulam Ali in his blue and gold Peshawar lungi, we went to the yamen on the best horses. Here there were the usual seven carved gates to go through in succession, the passage accompanied by loud salutes from a sort of mortar. Having got through the seventh gate we dismounted, and I met the Amban, who was dressed in a black serge patrol jacket of European cut, trousers to match, Chinese felt-soled boots, and a peaked cap of European shape bearing a gilt dragon crest. He took us in to tea, and employing a double relay of interpreters we carried on a polite conversation. The Chinese officials do not speak the language of the country, and employ Turkoman interpreters, who wear false pigtails and dress as Chinamen. Having ceremoniously taken tea, I left my passport with his secretary and we returned. He sent me a present of grain, grass, and fuel, and in return I sent him a bottle of Crême de Menthe, which he much appreciated, coming the next day to pay a return call to say so.

We rested a day at Karghalik, and several Indian and Pathan traders were brought to me by the Aksakal to pay their salaams. From here onwards on every march all British subjects, whether Hindu or Mohammedan, would come out many miles to meet me, on their best horses and dressed in their best clothes. They all seemed extremely pleased to see a British officer, and did everything they could to make me comfortable. This, I think, was entirely due to their feeling of loyalty and to Sir George Macartney's influence. There were a considerable number of Afghans,

who had no hesitation in telling me that they were British subjects, and were extremely pleased to hear that I came from Mardan and could speak Pashtu.

The next two days took us to Yarkand, the intermediate stage being Posgam. I tried travelling in a "mapa," a Chinese cart with huge wheels and tyres studded with gigantic nails. The vibration caused by these was beyond belief, though by sitting on an air cushion I managed to endure for a few hours at a time. At Posgam I was entertained by a man from Muzufferabad, on the Khagan Kashmir border, who had served in the Hunza expedition in 1891, and had received a sword wound on the scalp which resulted in an enormous cyst on the side of the face. In the sarai here, where he had got a room ready for me, there was the Chinese official in charge at Guma, and travelling back to that place from Yarkand. He was also dressed in Europeanized khaki uniform, and his orderly was so exactly like a Ghurka signaller in my regiment that Ghulam Ali at once called him Dambar Sing Gurumg after him. The Chinese official came to call on me, so again I had to don my review order. He had served in Eastern China, and was acquainted with European ways. He set off the next morning about the same time that I did, on a fine-looking Mongol pony.

After a very similar march to the preceding ones we reached Yarkand, and were put up in a house just outside the city walls by the Aksakal, a fine old Pathan from Bajaur. Here I met Mr. Cotton, I.C.S., who had come over the Pamirs, and proposed to return to India across the Lingzi-thang. I spent three days at Yarkand, calling on the Swedish missionaries and the Chinese Amban. The latter was one of the old school in his retinue and surroundings; the only European thing about him was his hat, which was of soft black felt. He also was extremely good to me, and gave me a sort of "laisser passer." In the yamen here were several criminals expiating their sentences, some in cages, and one with a log of wood chained to his neck and ankle.

Yarkand is rather a disappointing city. Like all the big towns in Central Asia there are separate Chinese and Mohammedan quarters, the former called Yangi-shahr and the latter Koneh-shahr. The Koneh-shahr is a great collection of narrow streets and bazaars, mostly covered over as a protection from the sun. There are many Chinese shops, the majority of which seem to be pawnbrokers. The Yangi-shahr communicates with these by a bridge over its moat, leading into a fine gateway. This is a portion of the high and well-kept wall of the Chinese city, which is separated from the old city, the latter having a wall of its own. The gates are shut punctually at dusk. The heat began to be pronounced, and so I marched out through the Yangi-shahr at 10 p.m. I passed a small mud fort, Utekchi Langar, which forms a sort of desert lighthouse, a red lamp being hoisted on a staff as a guide to travellers.

The road is very dusty and toilsome and leads across a desolate tract

due north towards Yangi Hissar. Early in the morning I reached a village called Kizil Bazar and slept in one of the houses. When we woke it was bright daylight, and going into the courtyard I was surprised to meet a Cossack subaltern with four of his men. His name was Gorieff, and he belonged to the 5th Orenburg regiment. They were travelling very light, with nothing but what they carried with one spare horse. Their turn-out struck me as being distinctly smart, and rather a contrast to Ghulam Ali and myself, who were now a bit travel stained. One of the Cossacks was a Mohammedan named Rakhmat. It came as a shock to Ghulam Ali to find Mohammedans and Christians soldiering in the same squadron. Gorieff and I breakfasted together, conversing by means of a pair of interpreters. On August 10 I reached Yangi Hissar (new fort). This is the third biggest town in Turkestan and has an imposing and well-kept fort standing a little away from the bazaar.

The Aksakal here was a Hindu, and he put me up in his house and entertained the party most hospitably. The next place was Yapchan. Here I met an Afghan trader who, in common with the other Afghans in the country, considered himself a British subject. Early next morning we pushed on to Kashgar, first crossing the Khan Arik River in a big ferry-boat. At about halfway I met a mounted man who had a letter for me from Sir George Macartney. This note ended by saying that there was a rumour of war between Germany and Russia, which came as rather a shock, since when I left India the whole of Europe was utterly peaceful. About 4 miles before reaching Kashgar I passed the Yangi-shahr and saw a number of Chinese soldiers strolling about the bazaar. They were all well dressed in black uniforms of European cut and peaked caps with a brass dragon badge.

I was very kindly and hospitably received by Sir George and Lady Macartney, and met Mr. Hayden of the Geological Survey of India. The principal talk of course was about the rumour of the European war. I called on the Cossack Mess and Prince Mischersky, the Russian Consul. He advised me to wait for a few days until the mail should come through from the Russian post Irkeshtam. Eventually the jigit arrived with a great handful of telegrams containing news of the apocryphal battle in the North Sea, the despatch of the British Expeditionary Force, the retreat from Mons, and the siege of Königsberg. This news decided my future movements, and so after lunching with the Chinese Amban—a repast which ran into over thirty courses—I supped with the Cossack officers, drinking confusion to the Germans, and pushed off early next morning with Mr. Hayden to Min Yol (the thousand roads). This was a long march across a high plain, and just took us into the foothills. I had decided to send Ghulam Ali back to India; so giving him some money, a bag of flour, and a horse and saddle, I indicated the way back to India over the Pamirs, and trusted he would arrive in about three months. He completed his journey, and I next saw him in Belgium, where he stopped a German bullet in the neighbourhood of Ypres.

From Min Yol our road lay through the Trans-Alai mountains *viâ* Irkeshtam, Osh to Andijan. The country and the track were very like the Indian frontier. From Kashgar to Andijan took nine days, making long marches and crossing the Terek Pass. Irkeshtam was reached on the fourth day from Kashgar: a polygonal stone fort with a moat and a garrison of Cossacks, with a telegraph office and a Russian customs post, in view of the considerable trade that passes between Russia and China. The telegraph line was not working much eastward of Irkeshtam, but there were a number of telegraph poles along the road ready to be erected. This route is traversable by camels, though not by any sort of wheeled transport. At every stage there is a room for travellers, generally in a farm or sarai. The ascent to the Terek Dawan is quite easy though rocky, and there is a Russian rest house about an hour's march down on the south side of it. The descent is distinctly steep, and many skeletons testified to the trouble caravans have in crossing it in bad weather. Across the pass there is another rest-house called Kizil Kurghan, and a little further on the track drops down a long steep and rocky gully with precipitous sides, at the foot of which is a Kirghiz encampment. Two marches further on we reached Sufi Kurghan, after marching through an enclosed but fertile valley. Here the track joined the Alai road over the Taldik Dawan and the telegraph line; there were also Russian verst posts, painted red, white, and blue, and the road became distinctly possible for wheels.

The next stage was Gulcha, where there is another obsolete earthwork fort, and quite a large garrison of Cossacks. From here there are two roads to Osh: one easy, bearing westwards, the other due north-west over the hills, and passable only for pack-transport. We took the latter over the Kaplan Kul Pass and were rewarded by a fine view of the lower Alai Hills. These are far less rugged than any I had seen, and were covered with grass; and in the valleys were many isolated homesteads. We passed the night in a barn in a village halfway to Osh. Here I saw for the first time one of the remarkable Kirghiz carts with wheels well over 7 feet in diameter. The single horse is harnessed between the shafts and ridden. This conveyance is called an Arba, and owing to its huge wheels and resiliency can be used to travel over the roughest country.

The next march was over very easy country, which seemed almost flat after what we had already passed through, and took us to Osh. On the way we passed a patrol of about six men, apparently on their way to Pamirski post. They seemed very well uniformed, equipped, and turned out; and not only the non-commissioned officer but each of the men had one of the excellent Russian maps which he was studying. They had the long "three-line" rifle slung from the right shoulder, the Cossack sword and dagger, but no bayonets or lances. We also passed a tribe of nomad Kirghiz on the move. All hands, men, women, and children, with their tents and property, were mounted on the huge Bactrian camels, the larger

of which were caparisoned with brightly coloured tassels and carpets. The last few miles into Osh were level in an almost European setting.

The town reminds one somewhat of Egypt, and is overlooked by a steep bare brown hill. Here we discharged our pack-ponies and proceeded along the high-road in a couple of landaus. A dusty drive through a richly cultivated and wooded country took us to Andijan, where we suddenly dropped into the civilization of electric light, railway terminus, and European shops. The effects of the war were already noticeable in the number of soldiers and reservists about the place.

We went to see the great cotton-seed oil mills under the guidance of an American engineer. The plant was remarkably up to date, driven by electric motors to which current was supplied from alternators actuated by 8000-horsepower Diesel engines. These prime movers are much in evidence in Russian Central Asia on account of the easy supplies of "mazub" or crude oil that comes from Baku. I noticed that a great number of the work-people were Persians, who had an almost inhuman reputation for industry. They were fine stalwart men to look at, and it seemed strange that they should be so lacking in manly qualities. Some of the remainder were Armenians. There were very few Turkomans or Sarts, as the Russians call them, as these people generally prefer idleness to hard work.

We entrained in the evening *en route* for Tashkent and Moscow Owing to the situation in Turkey I had to abandon any idea of going home *viâ* Baku and Batum. We travelled with the Governor of Skobelev (New Margelan)—the Aldershot or Rawal Pindi of these parts—where are the headquarters of the 5th Orenburg Cossacks and other troops. The General did everything he could to make us comfortable. The railway reminds one of India; but the beneficial effects of the "mazut" which is burnt on the railroads is very noticeable, in that rolling stock, stations, and everything remained perfectly clean. The difference this make to comfort in travelling can scarcely be imagined unless one has actually experienced it. The road-beds seemed securely laid with heavy rails, and the stations are solidly constructed of grey stone, and are remarkably clean. The signs of mobilization were everywhere.

Changing at Chernayevo, we reached Tashkent on the second day. This is called the Paris of Central Asia, and is certainly a remarkable city. The cantonment is absolutely European to look at, with hotels, shops and banks, electric trams and light. It gave one the impression of being centuries in advance of the Central Asia of Skobeleff's time, although the grass-covered ramparts of the fort bring his campaigns to mind. The Sartski city is quite separate and quite oriental, although on a much more affluent scale than Yarkand or Kashgar. Here we bought some carpets and shawls, having two or three days to wait for the return of the Governor-General's diplomatic secretary, without whose permission foreigners may not travel through Orenburg. The Governor-General was no

other than General Samsōnoff, who had made his name in the Japanese war and was killed while commanding the army then besieging Königsberg. His diplomatic secretary had been Russian Consul in Bombay, and knew all about India. He even had a servant who spoke Hindustani. He did everything he could to help us, and did not take long in giving us a permit for the Tashkent–Orenburg line. We left that night in the only non-troop train. Even this had a draft on board of the 4th Turkestan Rifles. Their officer, with another subaltern commanding machine-guns of the 6th Turkestan Regiment, took me to the car in which his men were travelling. I was very well impressed with them and their equipment. In physique they reminded one of Australians, and were darker than the average Russian of Europe, but very thick-set, hard and sturdy. They had excellent khaki uniforms, almost our shade of colour, and good knee-boots. They carried their great-coats *en banderole* over the left shoulder, with the ends tucked into a copper cooking-pot. The ammunition was carried in two pouches and a canvas bandolier; but the bayonet was, of course, always carried fixed, and each man had a spade on his belt similar in pattern to the German implement. The N.C.O.s had binoculars and compasses, and some had small axes. The machine-guns were in a separate company. The men seemed full of good spirits and contented.

It took us several days and nights to reach Orenburg, each day's journey seeming the same as the last. On both sides grassy steppes stretched to the horizon, almost always flat, and nowhere more undulating than Salisbury Plain. The stations were all exactly the same, with an oil tank, a water tank, and a greyish stone building. At frequent intervals there were sidings, in nearly every one of which was a troop train. Although the progress was slow and the country monotonous, the journey did not lack interest. It was strange to skirt the Sea of Aral with light-house and fishing-vessels in the middle of a huge continent.

Orenburg is a picturesque town on the border between Europe and Asia. The railway approaches it over a big iron bridge, from which is obtained an excellent view of the town, whose gilt and bronze domes and coloured buildings form a pleasant foreground to the Ural Hills in the background. Here were more newish-looking barracks and Cossacks. From Moscow I had to hurry home through Petrograd, Finland, and Torneå. Sweden seemed completely mobilized and very pro-German. In spite of this, apart from the official precautions against misdoings on our part, we were very courteously treated, and my passport, covered with Chinese stamps and writings, not to mention Russian and Indian inscriptions, was a great source of wonder to the officials. Avoiding Stockholm we passed through Christiania to Bergen, whence a very small Norwegian steamer took us across the North Sea. Every member of the crew appeared to spend his time with his eyes goggling out looking for mines, but we arrived safely, and that evening saw me in the War Office, thus

completing a journey which ended up very differently from what I had anticipated.

The road journey was by no means so arduous as I had expected, and the only real difficulties that I met were at the crossings of the rivers, which in the Kuen-Lun are much larger and swifter than I had anticipated. The desert in Turkestan, though sultry, is nothing to one used to Indian hot weather, whilst the fruit in the villages of the oasis makes up for a good deal.

The hospitality that I met with everywhere from the inhabitants, whether Russians, Cossacks, Kirghiz, Tibetans, Hindus, Pathans, or Turkomans, must be experienced to be appreciated; more especially the goodwill of the Indians in the villages showed that their loyalty to the British Government was more than a mere phrase, and made me think that the sedition one had heard so much about in India was even more of the nature of froth than could have been imagined.

The great heights traversed had no ill effects whatever either on beast or man. Ghulam Ali, it is true, suffered a little from mountain sickness in the Shaiok Valley, but I think this was mainly the result of farewell banquets at Leh. Not even when camping at 18,000 feet did any one suffer from insomnia. The only casualty was the pony that was drowned at Togra Su. Several of the animals acquired sore backs, but the treatment with equal parts of iodoform and boracic acid gave results little short of marvellous, and the general state of the ponies at the end of the journey was infinitely better than in the ordinary caravan.

The Shaiok route is most interesting, and undoubtedly far superior to the Nubra. I am positive that it could be traversed by camels, and the amount of vegetation for grazing is by no means beneath contempt. Since Major Wood's party had surveyed the valley, I did not spend much time on its topography, merely taking compass bearings from point to point, and recording aneroid readings. The latter, as mentioned in the itinerary, must be taken as relative, and were only taken to show the ups and downs of the day's march, and not with any idea of accuracy.

In Turkestan the people looked remarkably well fed and prosperous, the astonishing lack of sanitation seeming to have little ill effect, presumably on account of the extreme dryness of the country. In Kashgar and to a certain extent in Yarkand Russian influence was very prominent, not only in the presence of the troops, but in the trade and currency, the rouble passing freely.

The coin of the country is the seer, corresponding to the Chinese tael: a silver coin, no two specimens of which seem to be the same in pattern or size, and valued at about two rupees. I found that sovereigns were quite acceptable to the Kirghiz and the Turkomen, though they had never seen them before; they were quite willing, however, to take my word for their value. There are smaller silver coins, but the principal copper coin is the darchin; about the size of a halfpenny with a square hole in the

middle. About four hundred of these go to the seer or tael, so that for any purchase a pony-load of copper coins is needed. I noticed also a great number of roughly printed but artistic Chinese notes, with a huge pink and yellow dragon on one side. These were lithographed on mulberry paper, and were introduced to the extent of several millions by the Republican Government. Since they were never even theoretically supposed to have any equivalent in bullion, and were not exchangeable when worn out, their introduction was a stroke of financial genius. The wear and tear on them was great, and any merchant who refused to accept a paper note was led to the executioner, whose establishment is a prominent feature of all the towns and villages. Two beheading swords with the blades painted red are hung up on either side of the door of the police station.

In Ferghana (Russian Turkestan) the population seemed even more prosperous and well-to-do than in Chinese Turkestan. The country is marvellously fertile and the crops, especially of cotton, beyond belief. On the upland farms in the Alai one saw Russian settlers occupying holdings on the same scale and in the same condition as their Kirghiz neighbours.

Note on the name Shyok or Shaiok.

The name has usually been written Shyok; but on one sheet of the Indian Atlas it is Shayok, and on "Punjab N.W. Frontier Province and Kashmir, 1909," it is written Shaiok. The latter spelling has been adopted in this paper, in the belief that the second-mentioned sheet represented the mature opinion of the Survey of India. On still later sheets they have, however, reverted to Shyok, which should, by the usual rules of geographical spelling, treat the *y* as consonantal and be pronounced as a monosyllable. If the word is a disyllable, and the first vowel sound a diphthong having the sound of *y* in 'why' or of *ai* in 'aisle,' the name should be spelled Shaiok rather than Shyok. Pending a decision by the Survey of India, the spelling of the name here adopted should not be taken as certain.—ED. *G.J.*

EROSION AND THE RESULTING LAND FORMS IN SUB-ARID WESTERN AUSTRALIA, INCLUDING THE ORIGIN AND GROWTH OF THE DRY LAKES

J. T. Jutson, Geological Survey of Western Australia

(*By permission of the Director of the Survey*)

Read at the Afternoon Meeting of the Society, 22 February 1917.

IN the writer's work on the physiography of Western Australia, the process of arid erosion in the Salt Lake Division was described to some extent, and the origin of the 'dry' or 'salt' lakes of that area was discussed. Since then the writer has given closer attention to the subject in the field, and is therefore in a position to discuss more fully the various

problems, which are of high interest not only for Western Australia, but as bearing on arid erosion in general.

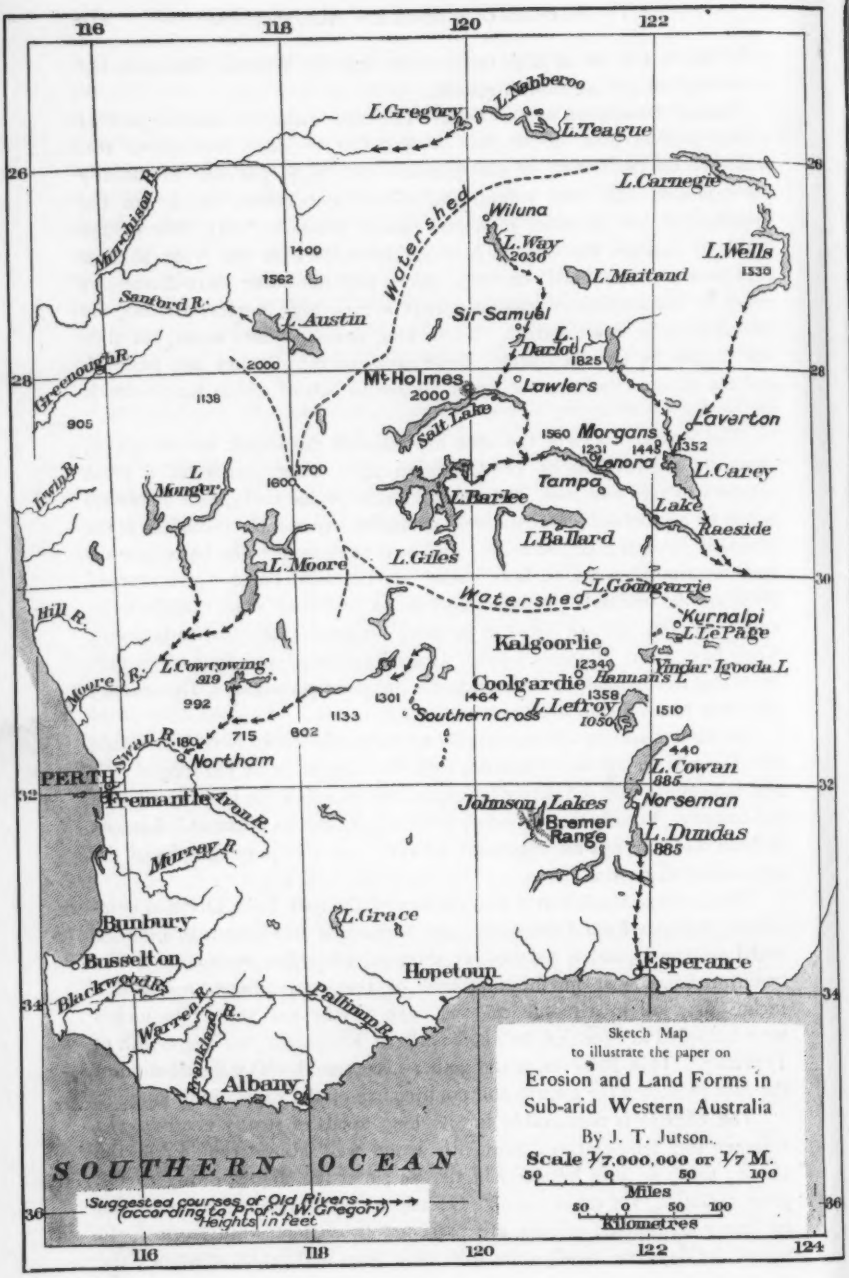
General Description of the Area.—The Salt Lake Division is part of a vast plateau from about 700 or 800 feet to 2000 feet above sea. Scattered on the surface of this plateau—the 'new' plateau—are usually low rounded hills and ridges, and mesas and buttes, which are the remnants of one or more than one earlier plateau. Very little of the drainage reaches the sea, as it tends to collect in the wide shallow depressions of the 'salt' or 'dry' lakes, and the water there disappears either by evaporation or soakage; there are no high barriers dividing the inland from the coastal areas. Some long drainage lines occur, but they can hardly be termed rivers. Wide areas of the country are pastoral, and the division includes the great auriferous belt of which Kalgoorlie is the centre.

The surface rocks of the area are some of the oldest on the globe, generally regarded as of pre-Cambrian age. They consist of a great complex of acid and basic igneous and metamorphic rocks, with numerous bands of undoubted comparatively unaltered sediments. Granitic rocks probably cover the largest areas; and next to these are the basic igneous and metamorphic series, here called by the field name 'greenstones.' Next are the unaltered sediments, which at one time were thought to be very restricted, but are found to be more extensive than hitherto believed. They have been intensely folded, sheared, fractured and faulted, to such an extent that schists or sediments are frequently vertical. The country therefore forms a truncated upland.

Sediments resting unconformably on these old rocks have been found in a few places. Primary laterites form the caps of many flat-topped hills and tablelands, and secondary laterites cover much of the lower portion of the country. Locally the secondary laterite is known as 'cement.' Laterite in both its forms has an important influence on the physiography of the area under discussion.

The average rainfall over that portion of the Salt Lake Division comprising the area from Coolgardie and Kalgoorlie northwards to Leonora and Laverton is under, but not far short of, 10 inches per annum. The heaviest falls occur in the first half of the year. Between 5 and 6 inches may fall in a month, and in 1915, a very wet year, 7·32 inches were recorded at Menzies, 80 miles north of Kalgoorlie, for the month of February. This, however, is altogether exceptional. The distribution of the rain promotes the growth and continuance of the vegetation.

The climate is remarkable for its long spells of steady weather. In summer the temperatures frequently reach well above 100° F. in the shade; there is little humidity in the air; and the nights, owing to the great radiation, are usually cool. Occasional thunderstorms, accompanied by heavy downpours of rain, are preceded by violent wind storms. In winter the days are usually calm with blue skies and genial sunshine; the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L. Gregory
L. Nabberoo
L. Teague
L. Carnegie
Wiluna
L. Way
2030
L. Wells
1538
L. Maitland
Watershed
Murchison R.
Sanford R.
1400
1562
L. Austin
Sir Samuel
L. Darlot
1825
Greenough R.
2000
Mt. Holmes
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Lawlers
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Salt Lake
1560
Morgans
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Laverton
Irwin R.
L. Monger
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Lenora
L. Carey
Tampa
L. Barlee
Lake
Raeside
L. Ballard
L. Giles
L. Moore
L. Goongarrie
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Hill R.
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Moore R.
L. Cowrywing
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Southern Cross
1050
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Swan R.
180
Northam
440
L. Cowan
885
PERTH
Fremantle
Avon R.
Johnson Lakes
Norseman
Bremer Range
L. Dundas
885
Murray R.
Bunbury
L. Grace
Busselton
Hopetoun
Esperance
Blackwood R.
Warren R.
Pallinup R.
Frankland R.
Albany
SOUTHERN OCEAN
Suggested courses of Old Rivers
(according to Prof. J. W. Gregory)
Heights in feet
Sketch Map
to illustrate the paper on
Erosion and Land Forms in
Sub-arid Western Australia
By J. T. Jutson.
Scale 1/7,000,000 or 1/7 M.
50 0 50 100
Miles
50 0 50 100
Kilometres

Mallee Eucalypts and Spinifex on Leonora-Darlot road

White everlastings, Yerilla, north of Kalgoorlie: result of good rains. Small trees are Mulga

Lake Raeside, north of Kalgoorlie, looking east : partly dry, with film of salt and silt on rock floor in foreground

Salmon-gums and saltbush at Ora Banda, north-west of Kalgoorlie

nights very cold, and frosts not uncommon. Much of the rain is light, and soaks quickly into the ground. Evaporation is very great. At Coolgardie the mean for some years is 87·72 inches, and at Laverton is 146·90 inches. The climate and country may be classed as sub-arid.

Vegetation.—The southern portion of the division is characterized by numerous well-grown but not close-set eucalypts on most of the normal timbered plain country. Somewhere about 50 miles north of Kalgoorlie the eucalypts practically cease, and are succeeded by small trees or tall shrubs with thin leaves, mainly belonging to the acacias, and collectively known as "mulga." Over fairly wide areas in both divisions are saltbush flats, so named from the predominating low bush or shrub. On some of the flats eucalypts may be scattered, but in others they, and in fact all timber, are absent, the ground being solely occupied by the saltbush and other small shrubs, the most common of which are locally known as cottonbush and bluebush. The dearth of timber is evidently owing to the ground receiving water charged with salts, and to the evaporation of such water and consequent precipitation of the salts in the soil in such an amount as to prevent tree growth. After the normal or winter rains grass springs up, but rapidly disappears on the approach of summer. With more rain it becomes more plentiful, and may last for some months, but even then, except in specially favourable spots, it is in tufts, with much bare ground between. After seasonal rains annual plants cover wide areas with masses of colour.

The greenstone is generally characterized in the south by eucalypts known as salmon gums, which are usually well-grown trees with little shade; by a considerable variety of species amongst the taller shrubs; and by the saltbush and kindred small shrubs already referred to. The granite districts are often characterized by eucalypts known as mallee gums, by an abundance of what is locally termed 'spinifex,' and by few saltbush and similar plants.

Along the shallow drainage lines—characterized only by a furrow or a series of furrows from 2 to 6 feet deep, or at times not even possessing furrows—chiefly in greenstone country, vegetation is often abundant and dense, with a variety of shrubs and often eucalyptus trees. This thick vegetation is, however, usually confined to a strip of ground a comparatively few yards wide, which represents the thalweg of the watercourse. The country is frequently rather bare.

Around the margin of the dry lakes are extensive flat sandy areas with shrubs usually not more than 2 feet high, and much bare sandy ground between them. Grass seldom grows here; but samphire, mesembryanthemums, and related plants are sometimes found with the normal saltbush flora, and increase as the lake areas are approached. The mesembryanthemums form brilliant pink patches, and after good rains they grow rapidly, throwing out roots which firmly bind the soil.

The Sand Dunes often have a definite type of vegetation. Some of

the youngest, near the borders of the dry lakes, bear stunted pine-like trees with small shrubs between. Both trees and shrubs are rather sparse, so that the loose sand can be moved by the wind, although probably slowly.

The Land Forms.—The widespread occurrence of mesas and buttes, and of other hills and ridges, rising above the general surface from about 30 to 100 feet or perhaps higher, shows that they form the remains of a plateau now in course of dissection and gradual removal. This plateau the writer, in his work on the Physiography of Western Australia, considers to be part of the Great Plateau, which extends over almost the

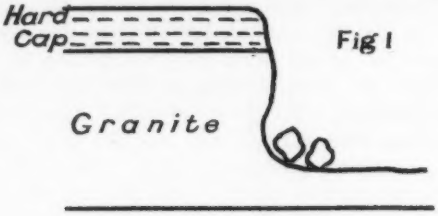

Fig 1

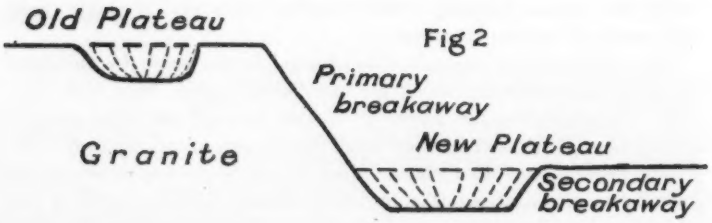

Fig 2

FIG. 1.—Section of a breakaway wall, due to undermining of cliff by waterfall.
FIG. 2.—Section showing formation of new plateau with primary breakaway: later dissection of new plateau with secondary breakaway; and further dissection of old plateau.

whole State. To distinguish the portion of the great plateau in sub-arid and arid areas from the present-forming plateau, the former has been styled by the writer the old plateau, and the latter the new plateau.

There are difficulties in correlating all remains of the old; but a well-marked plateau, older than the present-forming new plateau, is proved in so many places by the occurrence of rounded hills showing an approximately uniform height, and more particularly by the mesas and buttes, that there can be no doubt of its former widespread existence. The old plateau may be a continuation of that in Central Australia represented by the low flat-topped desert sandstone (of Upper Cretaceous age), hills with hard chalcedonized caps, described by Spencer and by Jack.

It is, however, a mistake to assume that every area rising by low cliffs from another area is a portion of this old plateau, because low cliffs of this character may be cut in the new plateau. The process of cliff-cutting will proceed in any part where the conditions are favourable.

The old plateau, evidently identical with Montgomery's "older marine plain," is undoubtedly one of erosion. The writer, after considering the possibilities of its origin by normal or by arid erosion, regarded the former as the more reasonable. This would mean that the surface was formerly much lower than at present. The great uplift, which later followed and brought the land to its present position, was placed in the late Tertiary, probably early or late Pliocene.

Very wide portions of the present surface of sub-arid Western Aus-

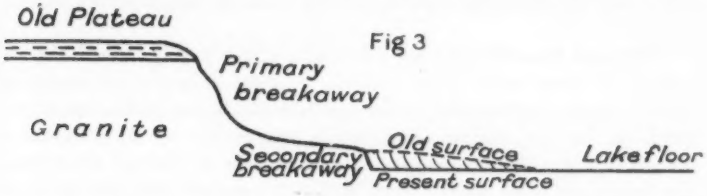

Fig 3

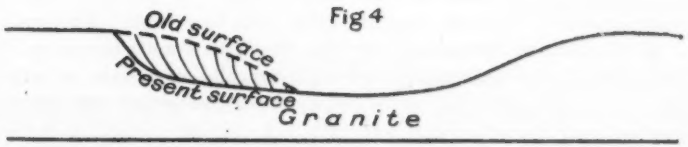

Fig 4

FIG. 3.—Section showing primary and secondary breakaways, with migration of lake floor by recession of latter.

FIG. 4.—Section of original valley with breakaway formed by cementing of thin band of detritus on slope of old surface.

tralia are a high plateau—the new plateau—which has apparently been either wholly or partly formed since the last great uplift of the land. This plateau is still being extended by sub-arid erosion, and it apparently forms a striking example of Passarge's great generalization as to the production of plains of erosion much above base-level, or, in other words, of "levelling without base-levelling."

Taken as a whole it rises to the north, and in parts to the east, but the northerly rise is probably the more pronounced. The plateau is gently undulating, but over wide areas is remarkably level. The greater portion of the new plateau is composed of the most easily eroded rocks, granites, gneisses, schists and the finer sediments. The transition from

the old to the new plateau is sometimes very gradual, but is frequently abrupt by means of the cliffs forming the sides of the mesas and buttes, and of the steep sides of certain of the greenstone and other hills.

The production of the new plateau is certainly far advanced, and the transition from the old to the new is rapid, with hardly any intermediate steps; but it must be remembered that the old plateau was somewhat dissected before the arid cycle commenced. The writer has shown that the drainage lines have become dismembered in places, but extensions are being made by headward erosion, and by capture some drainage lines are being united. The ultimate result of the present agencies, if no interruption occur, would apparently be a high level, practically rock-floored plain, surrounded by a few residuals of the highly resistant rocks. Deformation, or the encroachments of exterior drainage, may however prevent this.

Cliffs and Associated Forms—The steep cliffs—locally termed 'breakaways'—of from about 30 to 100 feet or more in height, but averaging perhaps about 50 feet, that so frequently separate the tablelands of the old from the new plateau, constitute a remarkable set of phenomena. The component rocks—sediments, greenstones, or granite, most often the last-named—are usually considerably decomposed, but they are protected, as a rule, by a hard cap due to the deposition of iron or silica, or of both, in varying proportions. The cap is mainly responsible for the cliff. The cliffs run in sinuous lines, with many indentations and tongue-like projections. The latter are the 'Zungenberge' of Walther. Small masses—buttes—separated from the main area, also occur. The heads of the canyons and basins may be either precipitous walls or a series of rock steps, narrow horizontally, and high vertically, or a series of steps wide horizontally and short vertically, these features giving rise, during times of heavy rains, to small waterfalls and cascades, according to the nature of the rock surface. Thus we have the 'dry' waterfalls and cascades of the sub-arid regions. Hume, in his valuable summary of the character of arid lands, refers to the dry waterfalls of the semi-desert.

The faces of the cliffs are much diversified. Thus where the hard cap is thin or almost entirely absent the cliff may descend in a steep slope from top to bottom without any distinct hollowing out. Frequently where a thick cap exists, rock hollows extending back up to 15 feet or more may be produced beneath the cap. At weak spots more or less circular holes are sometimes made, extending from the roof of the rock hollows upwards, or from the surface of the mesa downwards, producing 'blowholes.' Where buttes occur, the gradual narrowing of the crest, and the formation of rock hollows on either side, may result in 'natural bridges,' generally not more than 10 to 15 feet high and a few feet long. Around a butte, the formation of rock hollows on all sides produces a falling of huge blocks from the hard cap, which encumber the slopes and disclose clearly the origin of the boulders; and along many lines of cliffs

the breaking off of these blocks may be seen in all stages from the first crack to the boulders at the bottom of the cliffs.

Beneath the hard caps the softer, more decomposed rocks may become more or less covered with thin sheets of talus, usually not more than a foot thick, which at times becomes cemented together by iron, and in consequence acts as a protection to the softer rocks below. Weak spots are however generally found, and heavy rains will often furrow the surface, so that in course of time the furrows may develop into small gullies with a steep fall, broken in places by small rock steps. In other places the rain, when once it can get to the softer rocks, will rapidly gouge out more or less circular pit-like hollows, presenting such a close resemblance to

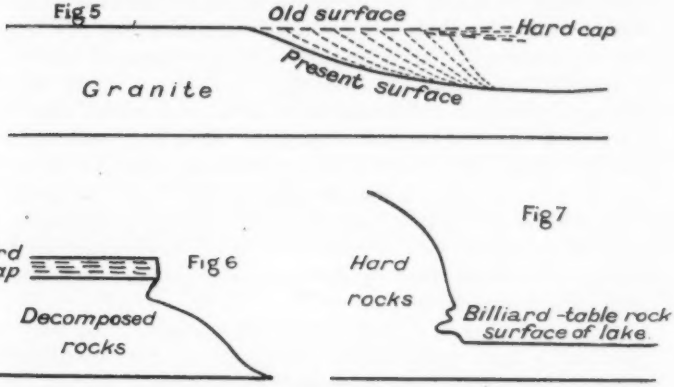

FIG. 5.—Section showing change of cliff into gentle slope by dying out of hard cap.
FIG. 6.—Typical section of breakaway with hard cap and undermining.
FIG. 7.—Section of lake cliff of hard rock, showing hollowing near base by exsudation and billiard-table rock floor.

quarries on a steep hillside that the writer proposes to term them 'natural quarries.'

The greenstones and the granite produce somewhat different details in the cliff faces. The granite cliffs are probably the much more abundant of the two series; and, on account mainly of the more irregular distribution of secondary iron beneath the hard cap in the cracks and joints of the rock, such cliffs usually present a mottled white and red appearance with varied sculpturing. The greenstones, on the other hand, are often a uniform brown colour, or brown with large white patches, and their faces, although frequently roughly furrowed and gouged, have not the detailed weathering of many of the granite fronts. The greenstone cliffs are therefore as a rule much more drab and plain than those of the granite.

The description just given applies to cliffs with a hard cap and more or less decomposed rocks beneath, and whether bordering lakes or not. But when lake cliffs are of hard rocks with no distinctively hard cap, the

cliff will rise sharply and vertically from the lake floor to 40 or 50 feet, and then recede at a fairly high angle to the horizontal. The lower portion is frequently hollowed out, and the upper portion wastes steadily by insolation and exsudation. Only a small amount of talus accumulates at the base.

The Dry Lakes. — *General Description.* — The lakes in south-central Western Australia cover many square miles of country, and in size vary in both length and breadth from many miles to a comparatively few yards. The smaller are better known as 'clay-pans.' Some of them are isolated, but many are more or less connected in long strings; yet the individual lakes so loosely connected have very different outlines and areas. After heavy rains the lakes may be covered wholly or in part with sheets of water, which are usually not more than from a few inches to a foot deep. With very heavy or fairly long-continued rain, water may flow from one lake to another; but this is probably not very common. Moreover the flow rapidly ceases, and the connecting arms become merely attenuated portions of the lakes. The evaporation is so great that the lakes rapidly dry up, and remain so for most of the year. Some water must also percolate into the ground, but as the level of the water table is in some cases very close to the surface, the extent of this percolation is not known. On evaporation of the surface water some salt and gypsum are usually precipitated, but as no thick deposits of these, as precipitated, are found, they must be blown away by the wind year by year; small dunes of gypsum are sometimes found.

The dry floors of the lakes are abnormally smooth and level. The lakes are in some cases actually rock-floored in parts, especially along their borders, and these rock-floors form 'billiard table' surfaces. Other portions are covered with fine detritus, brought mainly in suspension by the surface water, the thickness of which detritus in some cases is only a few inches. Quartz and other pebbles, miniature earth-pillars, and miniature hollow domes which are often broken occur on the lake floor.

The lakes are frequently bordered by low sandy country. This sand in places forms wide level tracts, but elsewhere it forms dunes only a few feet high, partly covered with vegetation. In some places cliffs of rock occur, the more decomposed rocks forming breakaways of the type previously described. Steep-sided, rocky islands of varying size occur in some lakes. Narrow stream-like channels often lead into and out of the lakes, but may or may not actually connect with other similar lakes. They undoubtedly represent the general drainage lines of the sub-arid country, although much water that falls never reaches the lakes. Towards the coast the lakes are connected with some of the seaward-draining streams, and hence a small portion of the surface water may ultimately reach the sea. The exterior drainage on the south and west is generally encroaching on to that of the interior.

Theories of their Origin.—The various theories that have been put forward may be briefly stated.

In 1897, H. P. Woodward, in a short but comprehensive paper, discussed the origin of the lakes and concluded that they are merely wind-planed flats. He explained their remarkable level floors as due to the subterranean water being always so near to the surface that the moisture, rising from it by capillary attraction, held together the particles, thus preventing either the superficial deposits, or the disintegrated rock below a certain level, from being removed by the wind.

W. D. Campbell in 1906 suggested that the deep hollows (now filled up with detritus) of Lake Cowan and of an area at Coolgardie may have been scooped out by ice. He regarded such hollows as rock basins.

A. Montgomery in various publications from the year 1909 to the year 1912 has suggested that the lakes are the remains of a widespread shallow sea, and that they were at one time more extensive than at present. He also apparently regarded the lake cliffs and the 'breakaways' generally as due to marine abrasion, and in some cases as the shore-lines of large old lakes, although some of the topographical features might, he thought, be formed under arid conditions. Victor Streich had previously suggested that the lakes were remnants of the sea.

C. G. Gibson in 1909 and again in 1911 regarded the salt lakes in general as the remains of large rivers flowing into the sea in Tertiary or pre-Tertiary time, the alteration being due to a change to a more arid climate, under which the rivers ceased to run, and their sources became more or less obliterated by the accumulation of wind-driven surface debris, sands, loam, etc.

In 1914, J. W. Gregory reviewed the theories of Woodward, Campbell, and Montgomery, but rejected each. He independently brought forward a theory which is practically identical with Gibson's, that the lakes are river systems of probably Miocene time, since dismembered.

In 1903 the present writer considered Woodward's and Montgomery's schemes, and accepted Woodward's main contention as to the wind origin of many of the lakes; but suggested that possibly some of the lakes were due to deformation of the Earth's surface, and consequently proposed a twofold classification into 'deflation lakes' and 'deformation lakes.' The theory of a present migration of the lakes was also brought forward. C. O. G. Larcombe had previously stated that many of the so-called clay-pans represented depressions which may be due to a warping of the Earth's surface, or perhaps unequal erosion. In 1913, C. S. Honman independently showed that some lake cliffs are receding, while sand is accumulating elsewhere on the lake-shores. He has also suggested the occurrence of former higher-level lakes, the margins of which are marked by the line of higher-level 'breakaways.'

The Origin and Migration of the Lakes, and their Relation to the 'Deep Leads' and to old River Systems.—The writer considers that some of the lakes are probably due to deformation, and that others are of sub-aerial

origin from which ice may be excluded. No definite evidence is at present available that the sea in late geological times extended further north than the Lake Cowan district, except to the east, as shown by the Eucla limestone. Moreover, sub-aerial erosion and deposition are now, and must have been since the last great uplift of the land, moulding the land-forms into their present shapes. That erosion has been considerable is suggested by the trenching of the plateau near the coast, which trenching has apparently been done since the uplift just referred to. Marine abrasion, therefore, as a factor in the formation of the present relief need not be here further considered.

In widely separated parts of sub-arid Western Australia auriferous 'deep leads' have been found. These are channels, or perhaps narrow basins, buried by accumulation of detritus, consisting of clays, sands and pebble beds. The leads vary in depth from a few feet to over 100 feet. Some undoubtedly represent old stream channels, as shown by the occurrence in them, according to Blatchford and Montgomery, of well water-worn pebbles. No lead has, however, been traced more than 3 miles, and an approach to this length is quite an exception. Some of the leads were apparently formed when the climate was moister than at present, whilst others could have been, and perhaps were, formed under the present conditions; consequently every lead is not necessarily indicative of a change of climate, and the leads as a whole may be of different ages.

Certain deep leads will probably be found to be connected with the lakes or hollows in which deep detrital deposits occur; but Maitland's observations show that in the area he describes the old water-channels were not continuous, and the old gutter would appear to be a much attenuated trough. On the present facts the leads throw little light on the origin of the lake system.

Woodward, Gibson, J. W. Gregory and the writer, though differing on the exact mode of origin of the lakes, all agree that some, and the cliffs bounding them, are due to subaerial erosion—excluding ice action. All four writers have recognized that some at least of the lakes occupy broad, general, but broken and disconnected drainage lines, although there are probably divergences of view as to the extent of these lines. The difficulty here, as in most other problems in Western Australian physiography, is the want of accurate topographical maps. The recent work of the Geological Survey is remedying this. The lakes and their connecting arms thus act as the main drainage receptacles of the country, and it was no doubt on account of their peculiar combination that Gibson used the term 'river-lake system.' As however the connecting arms largely run through sandhills and are frequently dry, and as portions of the lines of drainage are not indicated by any defined channel, but merely by extensive flats covered by salt-loving plants, the use of the term 'river' hardly seems warranted; but as some name is required to indicate the dual

Granite butte with ironstone cap, Cue, Murchison district

Breakaways at Niagara, north of Kalgoorlie

Small lake at Kanowna: the water not yet evaporated: typical samphire vegetation in foreground

Western shore of Lake Raeside, Yerilla, showing billiard-table rock floor and steep cliffs with little talus: rock floor nearly free of silt

capacity of portions of the drainage system, the present writer suggests the term 'stream-lake system' instead of 'river-lake system.'

While most are agreed that many of the lakes lie along the main drainage lines of the country, it is another question whether they are the remains of large rivers dating back at least to Miocene times. If, as the present writer believes, the agents now at work are sufficient to account for most of the existing surface features, independent evidence of these Miocene rivers is required, such as fluviatile deposits of old gravel and finer detritus. Where the climate has changed from normal to arid, such deposits stand a very great chance of being buried by sand or removed by erosion, which is active in arid as well as in more normal regions. But over such a vast area some of the old fluviatile deposits should be preserved, and should not all be buried, and fossil remains should be obtained; but few have been found in undoubted fluviatile or lacustrine deposits.

The old river gravels should be distinct from any coarse deposits of the present day, as the latter do not contain water-rounded pebbles. But such true gravels have not been found, except in the deep leads. Some of these leads do indicate the existence of a more normal drainage system in the recent geological past, but their connection with large old valleys lying under the lakes has yet to be established. Independent evidence is thus wanting that the stream-lake system belongs to an old large stream system dating back to Tertiary time.

Stream-lake System still forming.—A study of the present stream-lake system shows that, however such system originated, erosion and deposition are now active in modifying the land surface, and that this is but a stage in the evolution of the country under an arid climate. Moreover, these present processes seem to be producing the land forms now existing, and we need not assume that there are deep-buried old river channels. And although the lakes are in places more or less connected, and often lie along broad drainage lines, it does not follow that these are necessarily indications of a river system belonging to a moist climate. With a gradual general fall to the south, the present agents are, in the writer's opinion, quite sufficient to form general drainage lines running southwards.

Along the borders of the lakes sand dunes and sand plains are frequent. They mostly bear some vegetation, but the sand is not fixed, although it cannot be moving rapidly. The sand dunes and plains occur on all sides of the lakes; but where a lake trends approximately north and south, the sand is far more abundant on the eastern side than on the western. The direction of the prevailing winds is believed to be from the east or south-east; but so far as the writer's observation goes, the distribution of the dunes does not bear any special relation to the direction of the dominant wind, and they appear to be small and irregular. The sand is encroaching, in the main, westwards, tending to fill up the

lakes on their eastern sides, and to create barriers across drainage lines which may result in the formation of new lakes.

Sand-bars due to the wind occur in the lakes, and may cut off an arm. In this way minor distinct lakes are sometimes formed; but probably in most cases the rush of water after heavy rain suffices to keep open a narrow passage communicating with the main lake.

The rocky cliffs bounding some lakes are rapidly receding, the erosion being due to a combination of insolation, exsudation, atmospheric weathering (the chemical and mechanical action of rain), and wind erosion, including in the latter both corrasion and deflation. Concurrently with the recession of the cliffs a smooth 'billiard table' rock floor is produced, which becomes part of the lake-bed.

As the shore cliffs recede and the billiard table rock floors are formed, they are followed by the waters of the lake, which when the lakes fill nearly always reach to the foot of the cliff. Elsewhere the lake is encroached upon by the advancing sands. It is therefore clear that the lake is migrating.

A remarkable point about this lake migration is that the waters of the lake appear to be restricted to penetrating and softening the rocks, and (by means of the contained salts) bringing about exsudation. Similarly, the rain with its mechanical and chemical action on the cliff face, where it forms part of the ordinary atmospheric weathering, combined with the special factors of insolation and exsudation, does not bring about the actual results. All these factors, which may be termed the advance agents of lake migration, are insufficient to produce the prime essentials, namely, the smooth rock floor, practically free from the débris fallen from the cliffs, and the maintenance of the cliffs in their present form. In the writer's opinion, the wind is the agent that is mainly responsible for these features; it acts both in its corrasive and deflative character, although probably much more strongly in the latter than in the former. Without the wind acting in this way, the clean-swept billiard table surfaces and their sharp junction with the cliffs would not exist; débris would so accumulate that the foot of the cliff would be hidden; exsudation would probably cease as an active force on the rocks *in situ*; insolation would act strongly at the top of the cliff; the latter—in the case of a comparatively fresh rock with no hard cap—would lose its steepness; the talus from the cliff would form small flat cones or fans running out into the lake; and they in turn would be furrowed by the rain. The result would be a ragged uneven border to the lake.

It appears improbable that ordinary terrestrial water action can produce such unique features. The absence of any furrows, in either the rock or detrital floors, shows the weakness of water as an eroding agent here. Moreover, the water merely collects to form a shallow lake and lay down fine deposits. It is doubtful whether marine abrasion can cut such an extremely smooth and unfurrowed surface, and this is quite apart from the general want of evidence of marine action.

Many lakes have, where cliffs exist, those cliffs on the western side of the lakes, where the latter run approximately north and south, with sandy country on the opposite side. This appears to be corroborative of the effect of the wind in the removal of the cliffs, and the general migration westwards of the lakes.

It is impossible to state to what extent the lakes have migrated, nor can the time when migration commenced be definitely known, but it can date back only to the change of climate from normal to arid, and that must be comparatively recent. In Central Australia such change has been put down as Post-Pliocene (Baldwin Spencer, 'Narrative,' 174). Lake migration may not thus have extended very far; but it must be remembered that in those portions of arid countries where the rocks and ground are destitute of vegetation, as in the cliffs and floors of the lakes, erosion is extremely rapid; and it is quite possible that in some cases the lakes have moved a considerable distance from their original positions. However this may be, under a steady continuance of the present conditions no limits can apparently be placed as to the ultimate extent of such migration.

The writer's colleague Mr. C. S. Honman has described a group of lakes—the Johnson Lakes—which are split in half by a high north-north-westerly trending ridge known as the Bremer Range. This ridge is flanked by lake country on either side for 15 miles. On its eastern side the lake-bed is composed of solid bedrock for some considerable distance from the shore; and it is evident that on this side the ridge is being removed by erosion, and that the lake is migrating. It is difficult to account for these lakes on the theory of an ancient valley system. They appear rather to furnish strong evidence of much erosion since the inception of the lake system. An interesting phase of the migration of the lakes is that of the capture of portions of one system by portions of another, which has been first suggested by Honman for some lakes in the Mount Jackson district, north of Southern Cross.

Relation between Lakes and Water Table.—It seems undoubted that the surface of the underground water is, as a rule, close to the floor of the lakes, and that water, rising to the surface by capillary attraction, must certainly tend to bind the soil together, especially where salt is present, and so hinder wind erosion. This would operate more particularly immediately after the usual drying up of the lake. During continued dryness the level of the underground water would fall, and the production of surface moisture would not be so vigorous. The parching winds and hot sun would dry at least the surface films of matter, and these could be removed by the wind. The process would be repeated; and as, with the general lowering of the surface relief, the water-table falls, there seems to be no limit to the general downward action of the wind.

To produce the typical dry lake, the water must remain sufficiently long on the surface of the ground to kill the vegetation. If the water

also is or becomes salt, the plants will as a general rule more quickly succumb. Many flats are under water after heavy rains, but the water soon disappears and the vegetation remains. The reason appears to be that the water-table is some depth below the surface, and the water passes rapidly underground. Moreover such water is practically fresh, consequently the vegetation is not, as a rule, destroyed.

On the other hand, where the water-table is close to the surface, the ground very soon after continuous rain becomes practically full of water. Further, if the underground water be salt, as it frequently is, then the surface water probably mixes with it to some extent, and the conditions are favourable for killing the vegetation. A periodical recurrence of the necessary conditions causes the lake to become a permanent dry lake.

Montgomery has suggested that many of the present lakes are mere remnants of older and larger ones. This is probably true in certain cases, for large lake-like depressions exist which are apparently never fully occupied by water, although covered by distinctive vegetation, except on the bare patch periodically flooded. Such lakes may be migrating, and may never have been much larger. If lakes of very much greater size did at an earlier time exist, they were probably fresh-water, and we should expect to find some alluvial or rock terraces, but none has yet been recorded. We should also expect, under moister conditions of climate, lacustrine stratified beds containing fossil plants and animals; but, with the exception of the plant remains from the deep ground at Coolgardie (which has not been shown to have any connection with an existing lake) no stratified beds with fossil remains have yet been found.

Summary of Conclusions.—Rivers no doubt existed in Miocene time, but if the country had then been reduced to a peneplain, as seems possible, they would be old and meandering in shallow channels. On the great uplift, which the writer has suggested was in early or late Pliocene, such rivers may have been revived, or may have been broken up by warping, so as to form either elongated basins (some deep and some shallow), or broad, more circular basins. Which occurred—river revival or warping—cannot be definitely stated; but the known facts certainly point more to closed basins (whether deep or shallow, elongated or roughly circular) than to continuous buried valleys.

A moist climate apparently continued for some time after the uplift, as the change to the arid climate in Central Australia is put down by Baldwin Spencer as having taken place in Post-Pliocene times. During this moist period the revived rivers—if they existed—would be eroding; or the deformation basins—if they existed—would be in course of filling up, and some fossils (*e.g.* the Coolgardie plants) preserved in such deformation basins. When the arid change came, the filling up of the deeper hollows, whatever their origin, would still go on. Some of the present lakes may be above these deeper but now filled up hollows. Hence if the latter represented some of the remains of the old Miocene river valleys,

whether deformed or revived, there may be some distant connection between some of the existing lakes and such old rivers. But in view of the probability of the changes following the uplift, and later during the present dry cycle, having been so considerable as to determine the existing relief as essentially due to the cycle initiated on the uplift, the writer is unable to accept the proposition that a direct connection exists between the old Miocene rivers and the present lake system, and its corollary that the lakes are, in the main, merely the dead remains of such river system.

Given an undulating or more deformed surface—and such a surface (undulating at least) appears to be supported by the present contour of the country—then the existing agents seem competent to produce all existing phenomena, including valleys, plains, and lakes. The lakes appear to have been formed by the processes of advancing sands, formation of sand-bars, recession of lake-shore cliffs, and planing and hollowing out of rock floors. These processes have resulted in the formation, dismemberment, migration, growth, capture and union of lakes. Many factors are responsible for the results obtained, amongst which the wind is regarded as playing a prominent part.

Stone Fields, Pavements, and Desert Polish.—One of the most striking features in sub-arid Western Australia is the widespread stony detritus on the surface of the ground. The areas covered by this detritus may be divided into Stone Fields and Pavements, of which the former are much more common than the latter.

The component rocks of stone fields are chiefly quartz, jasper, and ironstone, with hard greenstone in very limited areas. The rock débris can be traced down the slopes of hills and ridges far out into the plains, in fragments varying from large boulders to pebbles half an inch or less in size, and getting smaller the farther they are from the parent rock. They are split by insolation, and remain angular. They topple forward as the rocks fracture, and as they are undermined by the removal of fine soil by the rain and the wind. This transport by gravity must be very slow; but the fragments travel considerable distances. The rocks mentioned are extremely hard; other rocks decay rapidly. The wind and the rain remove the soil that becomes mixed with the rocks, and the characteristic stone fields result.

Pavements are not very common in sub-arid Western Australia—at least within the writer's observation, but they do occur in limited areas. Corrasive action, which the writer regards as due to the wind, has been observed on them, but further details are required.

Desert polish is rather commonly found in sub-arid Western Australia amongst the ironstone fragments that help to form the stone fields described above. It occurs on the exposed surfaces of the pebbles, giving them a glazed or very shiny appearance, varying in colour from a deep brown to almost black. This polish occurs at times on smoothed and roughly facetted pebbles, the form of which appears to be due to wind

corrasion. The surface film is evidently due to surface deposition on evaporation of water. The desert polish here noted is no doubt the third type of Walther's desert films, namely, the brown protective film. Walther believes the desert films are not directly due to rain or dew, but to evaporation of highly concentrated solutions (within the rock) drawn to the surface under the influence of the high temperatures. This seems to apply to the Western Australian type, but it may be noted that a widespread accumulation of quartz fragments has been noticed in which the upper exposed surface is covered with a film of red oxide of iron. The mass of the quartz is apparently free of iron, so that an outward source of supply is suggested in this case.

Rock holes, almost always in granite knobs and rises, usually not more than 4 or 5 feet in diameter, with a varying depth from a few inches to several feet, are interesting minor physical features. They have played an important part in the opening up of the country, on account of being natural conservers of fresh surface water in a country where water is frequently absent over extensive areas.

In concluding this paper, the writer desires to gratefully acknowledge the valuable and generous assistance he has, at various times, received from his field colleagues.

Before the paper the PRESIDENT said: The paper to be read this afternoon on the "Origin and Growth of the Dry Lakes of Western Australia" is by Mr. Jutson, of the Geological Survey of Australia. In his absence Mr. Lamplugh has kindly consented to read it.

In presenting a summary of the paper Mr. LAMPLUGH said: Mr. Jutson is an officer of the Geological Survey of Western Australia, and in the course of his field-work he has taken a keen interest in the surface features or physiography of the country as well as in the geology. He has already published a Survey Memoir giving an excellent account of the general physiography of the whole State, and in the paper he has sent to us he has re-stated and amplified his results in regard to an area of particular interest in the interior which he terms the Central or Salt Lake division. The outstanding feature of this area is the presence of innumerable shallow flat-floored basins which, after the rains, contain more or less water, but are usually dry. These are the 'lakes' that figure so conspicuously on the maps of this part of Australia. The map may give an erroneous idea to any one who takes his impression of the country solely from it, but the basins, even in their usual dry condition, are so remarkably lake-like, as I can vouch from personal experience, that the geographer is compelled to think of them as lakes whether they hold water or not. To the members of this Society the Australian Lake Country will be already familiar by reason of two recent papers (1914 and 1916) by Prof. J. W. Gregory, in which its features were discussed. Prof. Gregory explains the lakes as being the relics of an ancient river-system cut when the land was at a lower level and the climate moister, probably in Miocene times. One of the principal objects of Mr. Jutson's paper is to suggest that this explanation is not in itself sufficient, and that the lakes as they now exist are not simply portions of old river-valleys, though he agrees that such may have been the beginning of their history. In his opinion the lake-basins are still in process

of formation, and owe their origin largely, though not wholly, to the action of the wind. He considers that their position has not remained fixed in the original river-valley, but that by the continuous wearing back of their steep banks or 'breakaways' in some parts, and by the accumulation of wind-drifted material and downwash in others, the basins, under present conditions, are in slow migration, and play an important part in the lowering of the surface from the 'old plateau' level to the 'new plateau' level. With this introduction I will try to extract from Mr. Jutson's voluminous paper some of the observations and arguments on which his conclusions are based.

(*Mr. Lamplugh then read the paper printed above, and a discussion followed.*)

Prof. J. W. GREGORY: It is with great pleasure that I have listened to Mr. Lamplugh's interesting summary of Mr. Jutson's valuable paper. It reminded me of H. P. Woodward's paper of 1897, in which he explained these Western Australian lakes by wind erosion, but this conclusion was not generally accepted, as many of the lake basins are extremely deep. If they were all shallow billiard-table rock floors that theory would suffice; but some of them are over 400 feet deep, and it seems to me impossible to explain such deep basins by the action of the wind. When I suggested in the *Geographical Journal* that these lake basins are depressions along an ancient river system, there was no conclusive evidence of the age of the slope it drained. The limestone which gave the best indication was doubtfully attributed by the Western Australia Geological Survey to the Pleistocene. But owing to the kindness of the Survey further specimens of the limestone have been collected and sent to me, and they prove to be of Miocene age. Accordingly the ancient river channels must have been greatly modified, and Mr. Jutson's paper deals with the later modification by the wind of this ancient topography. Mr. Lamplugh considers that there cannot be any existing relic of a Miocene relief; but though there may not be in the recently folded oscillating areas of north-western Europe, the original inequalities of the Miocene may still exist in such stable areas as Australia, as is shown by the Murray valley and its tributary deep leads in northern Victoria. In regard to the three difficulties quoted from Mr. Jutson against the river-valley theory, some fossils have been found under the lake basins; in some of the bores put down into these lake floors well-bedded gravels have been found, and that some of the surface undulations date back to the Miocene would appear from the distribution of the limestones. Erosion by the wind is very slow; so though it has lowered the hills and high grounds between the valleys, they have been left. There are difficulties in the migration of the lakes, if the theory be applied to them all; the cliffs upon both sides seem to be of the same age, and if the lakes had migrated we should expect the cliff on the side from which the lake was retreating to show features of greater age than those on the side toward which the lake was advancing. Mr. Jutson's figure of one of the undercut cliffs would appear better explained by water erosion of the foot of the cliff than by the decay of rock rotted by the evaporation of water. In many cases the lake floors are not of newly planed rock. On some of these lake floors it is impossible to find any rock *in situ*. For lake basins which are a level plain of hard rock, the wind erosion theory is quite adequate; but where the lake floor is composed of thick accumulations of bedded drifts that theory seems inadequate. The wind theory alone does not explain the fact that these lakes occur in regular descending series. If they were formed by wind their levels should vary irregularly, and would be dependent upon the hardness of the rocks and

on various local characteristics. There is one point of practical importance that may result from the study of these lakes. If their fluviatile origin be correct, the thick silts in some of the deep basins may include potash deposits, which are of especial interest at present. I should like to congratulate Mr. Jutson on his very careful study of this subject, on lines which are sure to lead to the ultimate solution of the problem.

Dr. J. W. EVANS: I have really no special qualification to speak on this question, as I have never visited Australia. I am, however, very interested in Mr. Jutson's paper, because Western and Central Australia furnish us with an example by which we can understand some of the records of the arid periods in the history of our own country. With regard to the question of river action *versus* wind action in the region dealt with by the paper, the evidence brought forward seems to show that at present wind action is of greater importance. There is an absence in the area, as far as we can judge from the descriptions which have been given us, of any of the phenomena which accompany powerful river action. If river action has played a part in shaping the surface it must have been, as Prof. Gregory suggests, some way back in the history of the country. Even in deserts river action can be very powerful indeed, as in the Sahara. These streams only flow when heavy rainfall occurs, but they are very effective corroding agents, as evidenced by the deep gorges they have formed. In these 'lake' districts of Western Australia there are, I understand from Prof. Gregory, deep river valleys which have been entirely filled with detritus. The very fact that these valleys have been filled up in this way shows that river action has long ceased to operate to any extent. Why it should have done so is a mystery. It cannot be from the mere decrease in the rainfall, because I believe that Western Australia is subject to as heavy downfalls of rain as is the case with the Sahara. I would suggest that there must have been a decrease in the gradients due to changes of level, which has diminished the power of river action. The author suggests that crystallization is of very great importance in the crumbling of the rocks. We require, however, much more evidence than we have at present. I should like to see experiments made to ascertain before this view can be accepted whether rocks can be disintegrated in this way. There is a much more obvious explanation, and that is that the disintegration of rocks in deserts may be largely attributed to the alternation of hydration and desiccation. Where it is desired to convert chalk or slate into clay it can be effected by simply steeping the material in water and then exposing it to the sun, and repeating the process again and again until it is reduced entirely. This process must operate in nature wherever there is alternation of dry and wet periods.

Mr. LAMPLUGH: I have no personal conviction in this argument, but shall accept it as my duty to act as advocate for Mr. Jutson. I can certainly find good replies for him to most of the arguments that Prof. Gregory has put forward. The deep leads appealed to by Prof. Gregory are not surface features like the lakes, but are buried features sometimes found in boring and mining, and are not proved to be connected with the lakes. The breakaways which bound the lakes, sometimes on both sides, are shown by Mr. Jutson to be modern features that are still receding. They cannot have been in existence so long ago as Miocene times, yet they are the main limiting factors of the present lakes. By their recession they leave the 'billiard table' floors which, according to Mr. Jutson, become new parts of the shifting lake basins. Then with regard to the gradient of the series of lakes, which is perhaps Prof. Gregory's strongest argument, I think it may be replied that if, as Mr. Jutson

thinks, the basins are formed by subaerial weathering to the depth of the decomposed rock, which may extend down to, say, 200 or 300 feet below the surface, the series of hollows will necessarily affect the gradient of the original plateau. It is acknowledged that this plateau sloped southwards and westwards, therefore the shallow basins of equal depth which are scooped in it must participate in these gradients, whether they have been river-beds or not. After heavy rains the lakes are known to overflow one into another, and I believe that some of them may occasionally discharge into rivers that reach the western coast. At any rate, when I was in Western Australia I was told that the water of a river that was in heavy flood in the northern part of the coastal plain was found to have turned salt, much to the surprise of the settlers. The salt water was no doubt due to the overflow from the lake-basins of the interior.

It appears to me that the chief interest of these West Australian lake-basins is not in their relation to the drainage system of the country, but in their bearing upon the mode of origin of the curiously flat surfaces of rock, known to Mr. Jutson as 'billiard-table floors.' I have seen similar floors of wide extent in the interior of South Africa and on a smaller scale in Arizona, and they have always struck me as most difficult to explain. They are not plains of sedimentation, and are not in the least like the work of rivers. They appear to be developed mainly, if not entirely, under semi-arid conditions, and Mr. Jutson has shown that they are being produced at the present day along the margins of these 'pans' or temporary lake-basins in Australia. He has also shown incidentally that the destruction of the plateau is going on at a rate which renders it very unlikely that its present features can have lasted since Miocene times.

The PRESIDENT (Mr. DOUGLAS FRESHFIELD): It is not for a simple geographer to rush in where geologists tread with some hesitation and with uncertain steps. I must leave to others the questions immediately involved in the discussion we have just listened to. But since we have been shown singular examples of the disintegrating effect of wind and weather, it may perhaps be permissible for me to call your attention to one of the most extraordinary instances in Europe of such action. On the west coast of Corsica, a coast very much exposed to the full force of rain, sea, winds, and the sun's heat, the granite rocks have been torn and cut into towers and spires, and had windows pierced through them. The red rocks, the extraordinarily picturesque pinnacles and arches, rising against the blue waters of the Mediterranean, form one of the most remarkable and fascinating landscapes in Europe. But I am drifting away from the Scientific into the Picturesque. I must return to the subject of our meeting, and offer in your name our best thanks to the writer of the paper, and to Mr. Lamplugh, who has so kindly studied it carefully and given us such interesting comments on it; also to Prof. Gregory and to Dr. Evans, who have taken part in the discussion.

A NEW SERIES OF ECONOMIC MAPS FOR SCHOOL USE

George Philip

Read at the Afternoon Meeting of the Society, 26 April 1917. Map following page 472.

AT the present time the whole world is given to the study of maps; and the general public would seem to be able to assimilate all kinds of geographical information, so long as it is depicted in map-form. It must be confessed, however, that it is not easy to represent cartographically certain aspects of geography; and of these none presents greater difficulties to the map-maker than the branch of geographical science dealing with the Earth as the theatre of the production and exchange of commodities, which we call economic geography.

Hitherto map-makers in their attempt to illustrate this important branch of geography have failed, generally speaking, to achieve a clear, comparative picture of the economic conditions of the globe; and their maps are therefore of little value to the student of geography. It is probably for this reason that in the valuable report on 'Atlas Textual and Wall Maps for School and University Use,' issued in 1915 by a committee appointed by the British Association, economic maps are condemned. In that report it is laid down that "economic maps belong to special atlases or to text-books, and should be excluded from the school atlas."

We must all, I am sure, agree with this ruling, so far as the so-called economic maps in existing atlases are concerned. They are generally mere jumble-diagrams, sprinkled with minute symbols as if from a leaking kaleidoscope, and have little educational value. Reading further in the report however inclines one to the view that this condemnation refers only to such economic maps as I have described; for on page 8 we find—

"Words or conventional signs, indicating the distribution of economic productions, are strongly deprecated. If economic factors must be exhibited on a general map, solid colours or shading should be used to show the concentration of industrial population, or the locality of high production of two or three commodities of first magnitude."

This seems to imply that the retention of economic maps in the school atlas might have been regarded with equanimity by the committee which issued the report, provided such maps are compiled on the lines it suggests. And surely—in view of the increasing attention which is being given, and rightly given, to the teaching of commercial geography in our schools and colleges—if it be possible to evolve a series of economic maps of real educational value, then such a series should find a place in the scheme of every student's atlas. Holding this view, after the publication of the British Association Report I devoted a considerable amount of time and

thought to this confessedly difficult problem of economic maps; and at the Newcastle meeting of the British Association held last year submitted a map compiled on novel lines. As there was no time for a discussion at that meeting, Mr. Reeves, the president of the Section, suggested an afternoon meeting of the Society might be devoted to its consideration; and the Research Committee have given me this opportunity to explain the lines on which I have prepared the map you see on the screen.

In working out the map I began by a process of elimination, asking myself—What should an economic map *not* contain, or *not* attempt to show? The answer falls under three heads:

1. That the general use of conventional symbols or names for the distribution of natural products, commercial commodities, or industries should be avoided, as recommended in the British Association Report; because the peppering of symbols and the insertion of commodities by name over a map do not present to the eye a picture of particular products or industries, or show their comparative importance or value.

2. That the economic map should not aim at being in any way a substitute for a geographical text-book, for this reason, among others, that a map, being drawn throughout on a uniform scale, does not favour a comparative treatment; there being too little room to indicate clearly and with sufficient detail the various activities of highly developed commercial districts, and a superabundance of space for the less detailed information required for barren or undeveloped regions.

3. That, just as the school-atlas general map should not be obscured by a mass of detail, so the school atlas economic map should be confined to a graphic representation of broadly generalized commercial factors.

This clearing of the ground led to the conclusion that the economic map should be diagrammatic in character, and should aim at giving only a general view of the activities of mankind in regard to the production and distribution of commodities; that is to say, it should attempt to show—graphically—the stage of commercial or economic development actually reached in the region it depicts. If it succeeds in doing this, it should, in my opinion, form a useful supplementary aid to the teaching of geography from the commercial text-book.

How then, within the limits imposed by the size to which a school atlas is restricted, and the number of maps which it can afford to devote to economic geography, can we prepare a really useful series of economic maps? After experimenting on various lines, I decided that the right method to adopt was to associate the distribution of the population with the nature of its economic activities. This conclusion meant in effect that the groundwork of the economic map should be formed by the combination of a map showing the density or distribution of the population and a map showing regional vegetation. Only by weaving together the materials supplied by these two maps did it seem possible to obtain the

basis for a reliable representation of the progress achieved by man in his exploitation of the world and its resources, and of the general character of his various occupations.

In basing the compilation of my economic maps on this principle, the following points have been held in mind:—

1. To make the relative values of the economic factors shown on the map appeal to the eye by judiciously arranged gradations of colour. The regions of most intense economic development—and consequently of greatest density of population—are therefore tinted most strongly; and the scale of colour diminishes in strength with the decrease in population per square mile and in the stage of commercial development attained, until we reach pure white for those practically uninhabited regions which, by reason of their barrenness or lack of natural resources, are incapable of any degree of commercial development.

2. To restrict the use of conventional symbols to important coalfields, the distribution of which must be indicated because of their connection with every kind of industrial enterprise, and of such characteristic natural products as gold, silver, tin, petroleum, etc.

3. To mark only the *great* highways of commerce—on land, by rail and navigable waterway, and in certain poorly-developed regions by caravan; and on sea by steamer, giving the distances by land and sea, and showing the comparative volume of sea-borne trade.

4. To omit, for the sake of clearness, all but the most important names.

5. To attempt to indicate in some graphic manner the relative commercial importance of different countries and the general character of their staple industries.

and 6. To endeavour to depict the present stage in the commercial development of the whole world in a series of separate maps of the continents, drawn on a uniform scale and treated as far as possible on a uniform system for purposes of comparison, supplemented by a more detailed map of Europe on a larger scale.

Turning now to the economic map of Eurasia, which is compiled on the principles I have just explained, the eye is first struck by the purple and red tints denoting the great centres of human activity in Eurasia—the regions with over 512 inhabitants to the square mile, of highly developed manufacturing enterprise (coloured purple), and those devoted to horticultural or plantation industries (coloured red). To show clearly the individual industries characteristic of each of these purple or red patches is simply impossible; to attempt to do so is, I submit, to go beyond the scope of a general economic map. Such details should be left to the intelligent teacher or the text-book to explain.

Only less prominent than the purple and red patches are the regions coloured dark green, indicating commercially developed productive areas, with a population of upwards of 128 inhabitants to the square mile. These areas include the fertile horticultural and agricultural regions in

China, India, and Europe, and in the tropics the commercially developed plantation colonies

The lighter grass-green tint denotes those generally fertile but less developed areas which, with a population of from 33 to 128 inhabitants to the square mile, are in the main agricultural or pastoral regions, and in the tropics under plantation cultivation.

Less productive or less developed regions, mainly given up to pastoral or agricultural occupations, but embracing also large tracts of tropical forest, I have divided into two zones, using a light green for the zone of higher development and production, with a population of from 17 to 32 inhabitants to the square mile; and a yellow tint for the less highly productive and developed zone, the population of which has a density of from 1 to 16 inhabitants to the square mile.

Undeveloped regions, carrying less than one inhabitant to the square mile, are again classed under two divisions. The upper zone, coloured light brown on the map, includes those regions which are capable of a varying degree of commercial development, though generally speaking they still await complete economic exploitation. They include the vast tracts of grassland, steppe, and semi-desert, mainly occupied by a sparse nomad population; and the primeval forests and savannahs of the tropics, with at most some native primitive cultivation. The second zone (left white on the map) comprises all those regions—desert, alpine, or polar—which because of their barrenness or inhospitable climate or the total absence of natural resources, are unsuited to commercial exploitation, and are indeed almost incapable of supporting human life.

A word or two on the other economic features superimposed on this attempt to illustrate the distribution of the population and the general nature of its occupations.

Firstly, with regard to the symbols employed on the map. The more important coalfields are inserted because, as already mentioned, their existence frequently explains the reason for the location of certain enterprises, and also because they generally extend over an area large enough to be laid down with tolerable accuracy even on a small-scale map. Their boundaries are indicated by black lines. A few other natural products, characteristic of Asia, such as petroleum, tin, and gold, are marked by symbols on the map. The selection of these would of course vary for each continent; thus, for Australasia I would suggest gold and silver; for Africa, gold and diamonds; North America, petroleum, gold, and silver; for South America, nitrate deposits; and for Europe, perhaps iron.

The method of treating the great highways of commerce was only decided on after many experiments. My first idea was to attempt to show by bands of varying width the comparative volume of trade carried both by the great land and sea routes. This, in the case of the overland routes, had to be discarded because it obscured the ground-colouring of the map.

A second attempt to indicate the present stage of railway development by showing in detail the complete railway network of Eurasia had to be abandoned for the same reason. Finally, I decided to show the main overland railways in black lines, and to indicate the mileage distances between railway junctions and their terminal ports. The chief caravan routes in undeveloped and desert regions are also marked.

For the sea-routes the system, familiar to us from German maps, of varying the width of the ocean trade-streams to indicate the comparative value of sea-borne commerce has been employed. The distances between ports are given in nautical miles in the sketch, but I should like to hear from any geographical teacher who may be present whether in their opinion it would not be better to show both sea and land distances in statute miles, so as to make it simpler for the youthful scholar to draw a correct comparison between the relative lengths of the great sea and land routes. Bearing in mind the diagrammatic character of the map, I have written in full only the country names, the leading centres of industry being located by their initials only. Perhaps, however, the great ports might with advantage be named in full. Lastly, though haunted by the fear that I might be running counter to the recommendations of the British Association Report, the feeling that a series of economic maps of the continents should give some indication of the character of the trade of different countries, led me to seek some graphic method of representing the nature and volume of international commerce.

The results are not altogether satisfactory. The principle finally adopted of associating the commerce of each country with the trade of its chief ports is, I think, a sound one, and it was a simple matter to give a general idea of the relative importance of the principal seaports of Asia by grading their town-stamps or symbols according to the volume of their foreign trade. To describe the character of their exports and imports is more difficult, but it is to be remembered that this information is not always to be found in the ordinary text-book. I have adopted the method of noting on the map the principal exports and imports of each port in the order of their importance. Perhaps a better alternative plan would be to give in a reference table a series of comparative graphs of the principal ports engaged in international commerce, showing the total value of their foreign trade, and the proportional amounts of the chief commodities. Such a reference table might be regarded as not trenching unduly on the domain of the geographical text-book.

A final word on the economic mapping of the other continents. I have not yet completed the compilation of these maps, but the detailed colour references on the screen will serve to show how I propose to deal with the continents other than Eurasia. With regard to these references, it is to be noted that the treatment is not altogether uniform. The comparative method is an excellent one, but it can be carried to the point of mere foolishness; and its strict use throughout a series of continental maps

would result in many of the typical economic characteristics of individual continents being ignored altogether.

It is clear, for instance, that if we adopt the same population groupings for the sparsely inhabited and mainly pastoral and agricultural continent of Australia as for densely peopled and industrially developed Europe, the treatment will fail to convey a correct idea of the stage reached in the commercial development of one or other of these two continents. Or again, both because of Europe's dominant commercial position, and the larger scale on which it is convenient to map it, it is desirable to show its economic factors in greater detail than those of the continent of Asia. As a matter of fact, however, the comparative treatment is adhered to in this instance by including the European peninsula on the map of Asia, so that its general commercial features can be studied in their relation to the larger continent. The supplementary map of Europe, with its larger scale, is designed to treat the economic characteristics of the separate European states with the greater detail that their importance demands.

It is necessary only to draw attention to the two main points in which the treatment adopted for the other continents differs from that of the Eurasia maps.

Highly developed regions, the centres of mining, manufacturing and intensive industrial enterprise, are associated with a population of over 256 inhabitants to the square mile, instead of over 512 as in the case of Europe and Asia. This is done because I found that the majority of highly developed districts in continents other than Eurasia would be excluded if the basis of the larger population-grouping was taken.

A dual colour scheme is employed with the object of differentiating the characteristic industries and occupations peculiar to temperate and tropical regions. This arrangement, although open to the objection that the special occupations of the transitional semi-tropical zone are apt to be lost sight of, has the distinct merit of allowing a greater mass of useful economic information to be shown with perfect clearness on the map. All the other minor deviations from the scheme of the Eurasia map are introduced in order to bring out the salient economic characteristics of the individual continents.

With regard to the selection of projections and scales, I should propose to follow the recommendations of the British Association Report. All the continents would be drawn on a uniform scale of 1/40,000,000 to facilitate comparison, with a scale of 1/10,000,000 for a supplementary map of Europe. For American atlases a second supplementary map of the commercial area of the North American continent on the scale of 1/20,000,000 might be added.

Lastly, may I add that the real value as a teaching medium of economic maps, drawn on these or any other systematic lines, is greatly enhanced if they be studied conjointly with other maps dealing with the physical, climatic, and political conditions of the same regions. In fact,

I venture to lay down the axiom that economic maps should be excluded altogether from the school atlas, as serving no useful educational purpose unless they are accompanied by companion maps of the same areas dealing with their physical features, climatology, natural vegetation, distribution of the population and political geography.

Such then are the principal features of this attempt by one who does not claim to have any experience in the teaching of geography, to solve the knotty problem of economic maps. Whatever the verdict may be on my effort to provide a series of economic maps of some value as a teaching medium, the discussion will, I trust, furnish conclusions that will repay the time spent this afternoon on the consideration of the problem.

(*After Mr. Philip read the paper printed above, a discussion followed.*)

Dr. MILL: I should have preferred that some one with special knowledge of education should have dealt with Mr. Philip's scheme before me, for obviously it is one that chiefly concerns education. It seems to me that a great deal of the trouble in mapping density of population has arisen from the fact that the mind of the map-maker is not sufficiently clear beforehand as to what he wanted to leave out and what he wanted to put in. On this point Mr. Philip has taken the right course. Whether such an atlas will serve the purpose it is intended to serve—whether it will clarify the mind instead of confusing it—must be left to the educational authorities to determine. Concerning one or two difficulties that occurred in the construction of these maps, I should be glad to know what steps Mr. Philip has taken. The primary problem in constructing a map of the density of population is to settle what area is to be taken as a unit. It stands to reason that if the whole population of New South Wales, for instance, were divided by the area of that State it would give an absurdly high density of population for the whole state outside Sydney; if the great towns were excluded an entirely different picture would be given. The same thing occurs in our own country, if a map is compiled with counties as units without excluding large towns. If the population were calculated only for land within a certain minimum distance of dwellings, even in England considerable areas of totally uninhabited land would appear. Take, for instance, the industrial region of the Pennines. There you have the densely peopled manufacturing areas of Lancashire and Yorkshire separated by absolutely unpopulated uplands. Such provisions are necessary in making a large-scale map of a comparatively small district; but at what reduction of scale should uninhabited land cease to appear, and at what reduction should great urban populations be distributed over the unit area?

These are points which would need to be clearly set forth in the accompanying letterpress of such an atlas. As for the use of symbols, I certainly think that in the case of coal and iron, gold and diamonds, such symbols are exceedingly useful, and might be employed for separating the industrial population from the mainly agricultural population. I am sure that I am expressing the general feeling when I congratulate Mr. Philip on the clear and luminous way in which he has described the specimen map illustrating his scheme.

Dr. UNSTEAD: I have been very glad indeed to hear this paper, both because of its intrinsic interest and because I am sure it will be of great service in drawing attention to the value of economic maps, to which, perhaps, justice was scarcely done in the Report to which Mr. Philip referred; and I think it is

very necessary that people should not be misdirected into neglecting economic maps. I am quite sure that when economic facts are mapped they may be understood and remembered far better than if they are expressed merely in words. This paper will be of great value if it can lead people to use economic maps more, rather than to use them less. I find myself in very considerable agreement with Mr. Philip as to the principles he laid down. Such maps should be simple, and the map before us, I think, certainly is simple enough for use. I would like to ask Mr. Philip about one or two points on which I am not clear. I take it that the density of the population and the vegetation are both taken into account in compiling this map, but that they do not overlap to any extent. I rather think that the density of population has been taken as a basis for densely populated regions, and that vegetation has been taken into account in others, but there is no region where there is any combination of the two. Thus one difficulty that occurred to me was this, that one sees a highly coloured area which indicates a dense population, and one is told that it is a highly developed region, but no distinction is made between one that is highly developed from the agricultural point of view, and one that is a crowded manufacturing region. From the teaching point of view the life of the people must be regarded as quite different, and I think that the regions should therefore be differentiated.

In regard to the symbols that are used I find myself in considerable agreement again; but would it not be desirable to add water power, especially in regions of the world where little coal is available?

I would certainly prefer to have the same units for miles on land and sea, and I think nothing but confusion could result from having two different terms. Children understand the land mile and not the sea mile, so the former would be more useful. I think initials are enough for the ports, and the plan of grading the size of the port symbols according to the value of the trade is quite good. To show the nature of the trade by small words is useful for the teacher, but could there not be some system by which these could be read by a class at a distance? The volume of trade from the principal ports is shown by the breadth of the band—could the band be composed of narrower bands of separate colours each indicating a different kind of trade, viz. raw materials, manufactured goods, food-stuffs, and coal?

I would ask why we have considered here only one map of each continent. Physical maps are numerous, and I should like to see an economic atlas with several maps for each continent. If this is not possible, however, then I consider that Mr. Philip's contribution of one map is very useful.

Mr. BARTON: May I be permitted to say that I came here to learn, and that I have been more than interested—I am delighted with the impression that Mr. Philip's map gives one. It conveys more to the mind than much reading, and the position of things as they stand in the world is much clearer to me than when I came here this afternoon. So far as increasing the amount of information is concerned, I should say that on the contrary Mr. Philip is very wise in keeping it down, and I would even advise him to reduce it. There is quite enough to give the desired impression, and the information given on the map can be amplified afterwards.

Now as to the use of miles, I quite agree with the last speaker that distances should be shown in one type of mile; I think it is quite unnecessary to think in two sets. I should also like to ask why Mr. Philip chose the units of 128 and 516 inhabitants to the square mile. I hope it is because he is preparing for the metric system. I should like to know further how Mr. Philip would deal with isolated spots in countries like Australia, as these maps seem to lend themselves

to dealing with large continents. I do not quite see how he would differentiate the different volumes of trade in such cases as the trade from this little corner of Europe with Holland, Belgium, and Germany, which would be in such volume as to completely cover the North Sea. I think it would be necessary to have enlarged maps showing each country, with its volume of trade, and following it down through the English Channel. I must add my expression of pleasure at hearing Mr. Philip's paper.

Miss E. L. DAWSON: May I suggest that when using physical and economic maps it would be very useful to have a transparent economic map to put over the physical map. Much time would be saved, and it would be very useful for the teacher. It struck me that I might just suggest this, as Mr. Philip said that economic maps should always be used in conjunction with physical and other maps.

Mr. HINKS: In the first place I should like to express regret that Mr. Reeves is away ill, and is unable to give this discussion the benefit of his very long experience. In his absence there are one or two points which I should like to raise. It seems to me that Mr. Philip has not given us a very clear idea as to how the layers on his map really differ from those showing merely the density of population. Would not a dense population quite undeveloped economically, as in China, where it is doubtful if you can say they are developed economically, be shown by the same colour? On the other hand, are there no places in America where there is an extremely high state of development with a small population? It seems to me that in this case rather more explanation is required than Mr. Philip has given us. Then I should like to suggest that an avoidance of the extremely hard and fast colouring would be an advantage. Would it not be possible to shade off the layers from one into the other, rather than to border them by hard lines? I thoroughly agree to the use of the statutory mile on sea as well as land; but you might express distances in days rather than in miles—days at a speed of 10 knots, for example, which gives a more intelligible idea than thousands of miles. The use of initials for names of ports is undoubtedly a good point—rather amusingly illustrated by a row of important places all beginning with B—Beirut, Baghdad, Basra, Bander Abbas, Bushire, Bombay. I should be disposed to differ from Dr. Unstead's view that the broad blue band showing volume of trade should be broken up into a polychromatic band; I think it would be wiser to keep it in blue. In this intricate subject one would like to have an opportunity of arguing out points in detail. May I add that it is far easier to criticize such a map than to make really useful suggestions for its improvement, for no one can tell until he tries what effect an alteration will make. Mr. Philip has shown us a map which we have been criticizing without having seen the very many things which he must have tried and rejected before he arrived at his present result. It is of great advantage that a man with draughtsmen and processes at command should have the desire to experiment towards improvement, and we must all be grateful to Mr. Philip for having taken this step forward in a long-delayed reform of the economic map.

Mr. PHILIP: To deal very briefly with the questions which have been raised, I think one or two of the speakers have not borne in mind that the map shown to-day is not intended to be reproduced in this form, but as one of a series, 12 × 10½, when its crudities will disappear. As regards the unit of population, 128 and 516 are powers of 2, and convenient. I have used groups taken from the smallest areas possible from census returns of different regions, and the computation of others has been estimated from population maps

specially prepared by myself in as great detail as I could possibly do it, and therefore I felt that its results gave me a basis to work upon. Any attempt to show urban population by spotting the map with spots of different sizes is very unsatisfactory. I am glad that Dr. Unstead agrees that the simplicity I aimed at is a good feature, but I think we should altogether get away from this if we introduced what Mr. Hinks called the polychromatic scheme. The idea of a symbol for water-power is, I think, an excellent one. I think my reference to Australia is a sufficient answer to the question of how to deal with the Australian Continent. With regard to the question of transparent maps, it would be possible to put symbols on transparent paper and superimpose them on another map, but such paper is a German production, and no further supplies would be forthcoming, at all events, until the end of the war. Small industrial areas with a large population are generally associated with some manufacture, and I think in almost all cases symbols would bring out that concentration of population sufficiently clearly. It must not be forgotten that these maps are highly generalized, and can only give a general impression of economic factors. If the map shown represents that general impression, it is all I wanted to do. It is a matter for the teacher to say whether it will be of service in general teaching, and it must in any case be supplemented by the intelligent teacher's own explanations. The line of demarcation would be as faint as possible ; it is really only inserted to give the printer an opportunity of registering his separate colours under one another. The only difficulty with regard to giving distances by rail and sea in days would be that unless you gave the days and the mileage as well, I am afraid it would not give a clear comparison. I think these are all the points raised, with the exception of one other. Mr. Hinks asked in what way does this map differ from the ordinary population map. It really shows the general density of the population identified with the character of the occupation of the population. I must thank you all very much for the attention you have given me this afternoon.

The PRESIDENT (Mr. DOUGLAS FRESHFIELD) : In moving a vote of thanks for this excellent paper I shall say very little, for two reasons : first, because it is on a technical subject on which I am not competent to dilate, and secondly, because Mr. Hinks has already anticipated some of the remarks which I might have attempted to make. All maps are a sort of shorthand, and I am always intensely grateful when maps take the place of pages of printed matter. I have often noticed how Germans delight in printing in a ponderous article of fifty pages what might have been shown in a single map. There is, however, a danger that we may endeavour to put too much into maps. I must confess that I share the doubt Mr. Hinks expresses as to whether it is desirable to represent population and production on the same map.

Mr. Philip tells us that his map is generalized, and in this case you cannot help having a certain amount of local inaccuracy. I notice, for instance, that while Baku is shaded, Maikop, also an oil-centre, is not ; and I think that the general production of Asia Minor is exaggerated. The expression of distance in the time of travel is a temporary and fugitive expedient, as Francis Galton found. His distance maps required republication every few years. We are grateful to Mr. Philip, and hope that he has found satisfaction in the discussion. Our own ideas have been much cleared up.

LANGUAGE AND NATIONALITY IN EUROPE

Frontiers of Language and Nationality in Europe.— Leon Dominian. Published for the American Geographical Society of New York by Henry Holt & Company. 1917. Crown 8vo. Pp. xviii. and 375.

IN his preface Mr. Dominian says that "this book is submitted as a study in applied geography. Its preparation grew out of a desire to trace the connection existing between linguistic areas in Europe and the subdivision of the continent into nations. The endeavour has been made to show that language exerts a strong formative influence on nationality, because words express thoughts and ideals. But underlying the currents of national feeling, or of speech, is found the persistent action of the land, or geography, which like the recurrent motif of an operatic composition prevails from beginning to end of the orchestration and endows it with unity of theme. Upon these foundations linguistic frontiers deserve recognition as the symbol of the divide between distinct sets of economic and social conditions."

Mr. Dominian has set himself the gigantic task of examining each European nation, except Great Britain and Ireland, Holland, Spain, and Portugal, but including Turkey, and setting forth of what racial ingredients it is composed, what are the languages spoken within its political confines, its social and political history, its geographical position, its economic problems, its ambitions, its traditions, and so on. In a single book, even of the noble proportions of this, such a task cannot possibly be carried out adequately; but Mr. Dominian has performed a remarkable feat in making the attempt. He has brought into one volume an immense quantity of data, dealing with all those problems of nationality and language which exist in a more or less acute form in almost all European countries. This is the supreme merit of his work, and it is by no means small. To have collected in one place for reference full statistics and much historical information concerning all the European and Asiatic nationalities and languages, and their confines, from the English Channel and the North Sea to the Persian Gulf and the Caspian, will certainly be a great boon to many who have not access to a large library. Mr. Dominian hopes that his book may be helpful and suggestive to those who have to settle the coming boundaries in Europe.

The value of the book is enhanced by the generous series of coloured maps and black and white figures and plates which accompany nearly every chapter. These were produced by the American Geographical Society some time ago, to illustrate a paper by the same author (*Bull. Amer. Geo. Soc.*, 47, 6). The use of town signs of varying shape to indicate the percentage of a certain nationality is a useful device, especially since the town populations are often very different from those of the surrounding country. The patches of the colour scales should have been larger; in their present size, with some want of register, they are of little use, especially by artificial light. And the colour assigned to Great Britain on Plate IX. might easily be interpreted as indicating the Serbo-Croatian tongue. The representation of the density of Armenian population in Plate VIII. cannot be commended. The sequence of colours is unnatural, and their effect is obscured by an overprinting of black which seems to discriminate between Armenians and 'Christians.' We may venture to commend to the author's notice the methods adopted by Mr. B. C. Wallis (*Geo. Journ.*, vol. 47, p. 177). In the linguistic map of Russia on p. 112 there is an unlucky misprint in the explanation: the *White* Russians of course occupy the space *diagonally* ruled.

Illustrations from photographs, many of them good, but some quite poor, are plentifully scattered throughout the book. A few are most apposite, such as the pictures of a farmhouse in the Schwarzwald and of a Wendish cottage; but views of the Cornice, of the Dolomites, of the Transylvanian plateau, or of Odessa harbour really have no bearing whatever on the problems discussed by the author, and if the view of a village in the Ukraine, buried in trees and with a hop-garden in the foreground, is what Mr. Dominian understands by "open steppe-land," it can only be said that he has no conception of what the steppe is like. If the author had reproduced pictures of the natives of each country he mentions and of their houses, it would have been extremely interesting; but perhaps the present difficult times made this impossible.

To come now to the gist of the book: Chapters II.–IV., on "the boundaries of French and German languages in Belgium and Luxemburg," "on the Franco-German linguistic boundary in Alsace-Lorraine and Switzerland," and "on the Borderlands of Italian language," are by far the best, and seem to have been much the most carefully prepared and written. The history of all these regions is carefully traced; the descriptions of how French liberal institutions have definitely won the heart and mind of Alsace though the country itself is Germanic, and the account of Switzerland as a nation, are especially good. In Chapter I., called the Foundations, Mr. Dominian rapidly outlines the manner in which the three great groups of languages, "Romanic, Germanic, and Slavonic," have emerged "out of the linguistic siftings of the past two millenniums," and proceeds to trace the position of the three languages which occupy the leading place in each group, French, German, and Russian. With his characterization of the last-named it is difficult to agree. Russian is absolutely and purely Indo-European; it is only in a geographical sense "a transition speech between Indo-European and Uralo-Altaic," whatever racial mixture there may have been, and it is not only its "inflections" which "connect it with the Western group." We do not understand the statement that "the dominant use of vowels bears impress of the strong influence exerted by Asia in the formation of the language." And when we are told that "the very consonants in Russian are liquid and softened so as to shade insensibly into vowels: these are characteristics of Turkish and Finnish," it must be pointed out that "the very consonants" in Polish, Bohemian, and Serbian are also softened in exactly the same way as in Russian; that in Russian some consonants are liquid, but many are not; and that the "softening" of consonants in Turkish and Finnish is quite different from that in Russian.

The language problem in Schleswig-Holstein is clearly dealt with in Chapter V., which also covers Norway, Sweden, Finland, and the Baltic provinces with the Letts and the Lithuanians. On p. 97 Mr. Dominian might have explained for the benefit of the unwary what *Maalstraev* means. As to Lithuanian, the author, who is sensitive with regard to the correct use of anthropometric terms, should be more precise in the phrase by which he describes this language, that it is "closely akin to the old Aryan," and specifies no further. As for the assertion that "almost any Lithuanian peasant can understand simple phrases in Sanskrit," well, Mr. Dominian may tell that to America! The geographical terms *Semigallia*, or *Zimigola*, and *Letgola*, which mean respectively *Land's End* and *Letts' End*, and are used as collective names of tribes, cannot be turned into plural names, 'Semigals' and 'Letgols,' as is here done. For 'Drina' presumably Dvina is meant (p. 104), yet on p. 105 it is called 'Duna.' 'Shmuds' should be written with initial 'Zh' or 'J.' In general Mr. Dominian is very inconsistent in his spelling and nomenclature;

thus on pp. 105 and 106 he uses both 'Estland' and 'Esthonia,' 'Livland' and 'Livonia.' On p. 105 he again mentions the 'old Aryan' of the Lithuanians; Lithuanians speak Lithuanian, and not 'old Aryan,' which is not 'in vogue' anywhere.

Chapter VI., the area of Polish speech, is well done, though the author seems to be confused with his dates on p. 118. The coloured map is good, but the spelling of the place-names on it is deplorable. Scarcely any of the Polish names are spelt right, and are not even put in their German forms; *e.g.* 'Chenstochow' is nothing at all, the Polish form being Częstochowa, the German Tschenstochau or Czenstochau and the Russian Chenstokhov; 'Prashysh' should be Przasnysz, 'Bielostock' should be Białystok,* 'Wloslawsk' should be Włocławek. 'Tezew,' the Polish for Dirschau, should be Tczewo. On p. 131 'Khursk' should be Kursk, and 'Stavropolskoi' Stavropolskaya, or the government of Stavropol. 'Terskaja' is an *oblast* or district, not a 'government,' and is really that 'of the river Terek.' In his table on p. 139 Mr. Dominian adopts the fantastic title of 'White Ruthenia' for White Russia, a title which is not based on any historical, linguistic, or ethnical fact, and is only used by extreme pan-Poles to try and prove that White Russia is not Russian. 'Kiovie' on the same page should be Kijów if in Polish, Kiev if in Russian.

Chapters VII. and VIII. on the Bohemian, Hungarian, and Rumanian languages, are hardly adequate in size to deal with these subjects, though the main facts are clearly put. But the Bohemian writer whom Mr. Dominian disguises as 'Sofarik' should be given either his correct name, viz. Šafařík, or else his German equivalent Schafarik. Again we have 'Kolár' on p. 148, and 'Kollar' on p. 151.

Chapter IX., on the Balkan peninsula and its Serbian inhabitants, is one of the best in the book. Mr. Dominian brings out clearly the essential unity and the need for union of the whole Serbian race, whether living in Dalmatia, Croatia, or in any other of the political divisions into which it has been arbitrarily split up. He should not have transcribed the Serbian proverb on p. 184 in so-called phonetic English,' when the Croatian (Latin) script, which is strictly phonetic, is at hand for the purpose. It must be added that 'tcha' is only used in a very small part of Croatia. Most Croatians say 'shto' (not 'chto') for 'what,' just as do Orthodox Serbs. One wonders whence he has got the form 'Pechui,' p. 188; the Magyar for Fünfkirchen is Pecs, a corruption of the old Slavonic for 5. Possibly he has confused it with Uj Pecs (= New Pecs), which figures in indexes as Pecs, Uj. 'Becherek' on the same page should be Becskerek. 'Novi Varosh' on p. 189 should be Nova Varosh = New Town. In dealing with the German linguistic island of Gottschee, sandwiched between Slovenes and Croats, on p. 79, it should have been mentioned that this is a corruption of the Slav name Kočevje, which means Nomads' Abode.

In Chapter X., dealing with the Language Problems of the Balkan Peninsula, Mr. Dominian discusses Albania (also mentioned in the previous chapter), Macedonia, and Bulgaria. He calls the Macedonian people "a transition people between" Serbians and Bulgarians, and their language 'intermediate' between those of these two peoples; but he then goes on to prove that the Macedonians are really Bulgars. It is quite true that there are many Bulgars in Macedonia, but there are also many Serbians, Greeks, Albanians, Jews, and Turks. It is also true that in certain parts of Macedonia ancient forms of Bulgarian are still used. But the ground fact remains that the Macedonian

* ł represents the Polish ł with a stroke across it.

Slavs *are* a transition people, who until forty years ago had no national consciousness. Consequently any propagandists who got hold of them could easily convert them for political purposes into Serbians or Bulgarians. The Bulgars were first in the field, hence their success; but to this day those Macedonian Slavs who have not been to school, and taught what they 'are,' call themselves mere Macedonians. Mr. Dominian favours the creation of a Bulgaria according to the treaty of San Stefano, but on his own showing (the map on p. 203) this would have included a large Serbian-speaking population. Few deny that the boundaries established in 1913 are imperfect; but it is also generally acknowledged that if Bulgaria had not treacherously attacked its ally Serbia in that year it would have got better terms. The creation of an independent Albania forced Serbia south-eastwards towards Salonika. Mr. Dominian thinks Albania is incapable of complete political independence. He may be right, but to divide the unfortunate country, as he suggests doing, between Greece and Serbia, would be to sacrifice to mere convenience all the principles for which the allies are fighting and he is writing. Whatever happens, whether it be made independent, or left in political charge of Italy or Greece or Serbia, it should not be divided, but should be left one "cultural" whole in order that its unfortunate but highly-gifted inhabitants—many believe they are the most gifted of the Balkan peoples—may at least have the chance of forming some sort of natural unit, as at present they form a linguistic bloc. But in Macedonia the languages and populations are so mixed up that, unless they are forcibly sifted and sorted out, there are bound to be linguistic minorities in all the countries concerned whatever frontier is fixed. Mr. Dominian should have realized that 'Boshnak,' on p. 189, is the Serbian for a male Bosnian, and should be written Bošnjak, from Bosna = Bosnia. Of course, one cannot expect an author to know all the languages with which he deals in a book of this size, but he should certainly be more accurate in the names of places and peoples.

Chapter XI., "the Geographical Case of Turkey"; and Chapter XII., "the Peoples of Turkey," really form a completely separate section of the book, because in Turkey, as, indeed, in the Balkan peninsula, there are no "frontiers of language," but merely mosaics of nationalities. In a way this is the best part of the book, because it is the subject with which Mr. Dominian is evidently most familiar, but its preparation seems to have been somewhat hurried compared with that of the earlier chapters. His descriptions and characterizations of Turkey as a meeting-place, a passage, and not a settled country, a home of any nation, are excellent. He predicts the dissolution of the Turkish empire, and describes the various economic spheres of influence which already exist, but he also has the perspicacity to describe Asia Minor as "a German colony in all but name."

In his summary and applications, which are embodied in Chapter XIII., it cannot be said that Mr. Dominian has arrived at any novel or startling conclusions. His general argument is that future political boundaries should take more account of language than they have done hitherto. With this few will disagree. But Mr. Dominian is as much puzzled as is any one how, for instance, to unite the Polish nation into a geographical whole without cutting the German nation in two. He is wise enough not even to suggest what is to be the fate of Constantinople. He predicts the dissolution of Austria-Hungary and of Turkey, and sees no difficulty in the creation of coastless Bohemias and Hungarys.

The principal defects of the book are (1) repetition, *e.g.* in Chapter XII., where the author tells us three times over that Russia built the railways in Northern Anatolia with French capital because it had none to spare of its own;

and (2) a variation in style between that of a philosophic treatise and of a commercial pamphlet, which hides the very great importance and the truth of much that he has to say. In a book dealing with such complex subjects simplicity of diction is the greatest desideratum, even at the cost of repeating the same word twice or thrice in one sentence.

The very considerable merits of the work have already been mentioned, and there is no doubt that the author and the American Geographical Society between them have produced a work of permanent value.

NEVILL FORBES.

MORE GERMAN PEACE MAPS

G. Freytag's Karte von Mittel-Europa mit den neuen Grenzen, 1/5 M. nach den "Kriegs- und Friedenszielen" von Frh. Albrecht von Rechenberg und Anderen, Mit Nebenkarte: Die neuen Grenzen des deutschen Kolonialbesitzer in Afrika, 1/30 M.: G. Freytag & Berndt, Wien [later than March, 1917]. 1 *Mark.*

Flemmings U-Boot-Kriegskarte von Europa, 1/7·5 M., Carl Flemming Verlag, A.G. Berlin und Glogau. No date. 1 *M.*

Map showing the Historical Development of the British Empire. Dietrich Reimer (Ernst Vohsen). Berlin: 1915.

IN the *Journal* for March 1917 we noticed No. 1 of 'Flemmings Friedenskarten,' kindly sent us by a Fellow of the Society resident in Switzerland. We are now indebted to him for a considerable parcel of German war and peace maps, of which the three above are the more interesting and worthy of detailed comment: a list of the whole will be given in list of Additions to the Map Room.

The first is based upon a work on War and Peace Aims which we have not yet seen. The "new boundaries" in Europe are shown for Germany, Austria, Bulgaria, and France. Austria acquires Montenegro, Albania, and Serbia west of the Morava. Bulgaria acquires the rest of Serbia and the Dobruja. Germany acquires Courland up to the Dvina, and the Flemish half of Belgium. France acquires the Walloon half of Belgium. The destiny of Poland is left indeterminate, while Belgium and Serbia disappear from the map. It would scarcely be worth while to discuss this map seriously were it not for the somewhat unexpected gift to France, which becomes interesting in the light of revelations in the recent Lenoir case, where mention was made of a "shameful offer" that had been made in an obscure way for the division of Belgium between France and Germany. The publication of this map shows that such an offer is a definite part of one line of German propaganda, and it should therefore not be dismissed as purely fantastic. But we may safely apply this adjective to an inset map of Africa, where the new German possessions (neuer Deutscher Besitz) include British East Africa, Uganda, the Anglo-Egyptian Sudan south of Lado, the French Sudan south of Lake Chad, the whole Belgian and French Congo, Nyasaland, part of Northern Rhodesia, and Mozambique to the Zambezi; while the old German South-West Africa figures as a new British possession. So much for the War and Peace Aims of von Rechenberg and others.

The Submarine War-Map—now quite out of date—makes much of the so-called "Erlaubter Weg für Amerikanische Passagierdampfer," and shows

the Sinai Peninsula as a conquest of Germany and her allies. The most curious feature is a "future world-traffic route" from Germany to the East, through Serajevo and Mostar to the coast about Ragusa, thence through Albania and Greece, across the west end of Crete to Ras el Tin, coastwise to Alexandria, and then across the Delta to Suez. The choice of such a route is 'wrop up in mystery.'

The third map is presumably for propaganda. It is all in pretty good English, but displays the name of the well-known Berlin publisher. British possessions are coloured red, and an ample reference-list shows against each a date, and a brief note of "How acquired." These notes have a certain acid or even toxic flavour: thus:—

Dominion of Canada, 1713–1763		Captured from France in the War of the Spanish Succession and in the Seven Years' War.
Falkland Islands	1832	Occupied despite previous Spanish claims.
Tasmania	1803	Occupied after previous Dutch settlements.
Sikhim	1890	Taken from China and declared a Protectorate.

Happily they are all plainly labelled "LEGEND." Egypt appears as "occupied and taken from Turkey during the insurrection of 1882"—whereas the Freytag map claims even the Anglo-Egyptian Sudan as still half Turkish. Lemnos and Tenedos appear for the first time as parts of the British Empire; but Togoland and German New Guinea and the rest of the then vanishing German Colonial Empire remain virgin white.

We will not on this occasion make the mistake of underrating even the most extravagant features of such maps. In our former note we were surprised at the idea that it was worth while to show the boundaries of the Ukraine Kingdom in the thirteenth century. Now it is only too plain that the separation of the Cossacks was part of the German reckoning; and we must recognize that outrageous productions of the private German map-publishers are more likely to be inspired by official wire-pullers than by unauthorized enthusiasts.

REVIEWS

ASIA

Bengal, Bihar and Orissa, Sikkim. (Provincial Geographies of India).—L. S. S. O'Malley. Cambridge: University Press. 1917. *6s. net.*

The editor of this series was well advised in disregarding the recent administrative changes, about which so much controversy has raged, and considering the whole area, geographically, in a single survey. To the student of the British connection with India the grant, in 1764, of the Diwani of the combined regions Bengal, Bihar, and Orissa, is the outstanding landmark of the transition from commerce to government. The 153 years that have elapsed show advances in order and material progress unequalled in any other country of the Old World, but, as shown in the excellent account herein given of the religious and social life of the people, the civilization which prevailed in the days of Clive remains in essentials as it was, or if progress has been here made it is strictly on the old lines, almost unpenetrated by foreign ideas.

In an area so large as that in question there are, of course, marked differences, physical, racial, and linguistic, which are concisely and explicitly set

forth in an introductory description. They are not exactly co-extensive with the administrative frontiers, but approximate sufficiently to justify the time-honoured tripartite subdivision.

The greatest variety is found in the western section, a considerable part of which consists of hill-tracts stretching far beyond the southern and western boundaries of the province. The other upland regions included in the area here dealt with are, so to speak, outside India proper. That skirting the Himalaya is quite a modern addition to British territory, while the other is more akin to western Burma. The paramount feature of the whole of this part of India is the vast alluvial plain of the Ganges, constituting the greater portion of Bihar, and, with its terminus in the amphibious conditions of a great delta, practically the whole of Bengal. The striking differences between these tracts are well brought out in the chapters on climate, population, and occupations. The swarthy denizens of the forest-clad hills of Chutia Nagpur and Orissa appear to furnish a complete Pactolus of primitive languages, customs, traditions, and views on life and death. The most remarkable and potent influence, upon the fringe of these tribes at all events, has been the temporary migration due to the opening of new labour fields by British industrial enterprise, either close at hand, in the coal districts, or as far away as the tea-gardens of Assam. The demand for alien labour in Bengal is no novelty, but until within the last generation or so it was restricted to porters from Orissa and the bodyguard of territorial magnates. The enervating climate and the extraordinary fertility of the lower Ganges valley tend to make the natives averse from arduous or risky physical pursuits, whilst, on the other hand, the keener struggle for life on the densely peopled plains of Bihar renders the hardier and more strenuous peasantry of that region ready to better itself by undertaking such duties. This migration, however, like that of the hill tribes, is but temporary, often indeed only seasonal. One of the drawbacks of this tendency, accordingly, to which the author calls attention, is the extent to which it retards the progress of factorial industry in Eastern India by preventing the formation of a permanent manufacturing element in the population. The workers, in fact, in their respective industries have to become a caste, even as have to a certain degree the cotton operatives of Lancashire.

The editor has again been fortunate in his choice of an expert to deal with this very important part of India. Mr. O'Malley was very successful in the hard task of following Sir Edward Gait in the Bengal census, and as editor of the district Gazetteers of the two provinces he has acquired a local knowledge which serves him admirably in the work under review. His chapters on the physical features of the country, and the races, religions, and industries of the people, are most instructive—and pleasant to read. J. A. B.

Mission A. F. Legendre: Massif Sino-Thibétain. Provinces du Setchouen, du Yunnan et Marches Thibétaines. Paris: Emile Larose. 1916.

The journeys of Dr. A. F. Legendre in Western Stechuen and Northern Yunnan, which were frequently referred to at the time in the *Journal* (see especially vol. 33, p. 327; vol. 39, pp. 72, 280), extended with interruptions due to political and other events from 1907 to 1912. During this time the whole of the very interesting loop of high mountain land enclosed in the bend of the Yangtse and Yalung rivers was thoroughly explored, together with a part of Yunnan south of the Yangtse, but unfortunately many of the notes and scientific data obtained were lost in an attack made upon the mission.

The volume now published is mainly devoted to geological studies of the

routes taken by the mission, and of the eruptive and rhætic rocks in the localities visited. These are illustrated by careful geological maps, and supplemented by a paper on the geological results obtained by the mission.

For geographers the most interesting part of the volume is the introduction written by Dr. Legendre. In this the traveller draws attention to the uniformity of the great plateau in the region under consideration. Despite the ravines by which the country is intersected, their depth and number, he holds that the whole of the country was one great plateau, with a general inclination from north to south and west to east, falling from 6000–5000 metres in the Yalung Valley to 4500–4000 metres between the Yalung and Nganning rivers, and to 3500 metres further east, in the Ta-lieng Shan and Wu Pao Shan. He found that the same general features characterized the portion of the Yunnan which he explored south of the Yangtse.

It is somewhat of a disillusionment to find that the Ta-lieng Shan, which so greatly excited the admiration and enthusiasm of the late Mr. E. Colborne Baber, has to be placed among the smaller features of this great system; but the fact perhaps helps to convey the gigantic scale of these outliers of the Himalayas.

The qualifications of an expert geologist would be needed to do justice to the valuable additions to geological information regarding this portion of China to which the main body of the volume is devoted, but which hardly come within the scope of a Geographical Journal. W. R. C.

AFRICA

Thrice Through the Dark Continent.— **J. du Plessis, B.A., B.D.** London: Longmans & Co. 1917. Pp. viii. and 350. *Maps and* 60 *Illustrations.* 14*s. net.*

Mr. du Plessis made his three journeys across Africa between February 1914 and January 1916. Of the 17,000 or so miles he covered approximately 2000 were made on foot. The greater part of the remaining 15,000 were traversed in river and lake steamers and on railways. No new, though some unfamiliar, ground had been visited, and the author modestly declares that the geographical results of his travels "are *nil.*" The book however is of considerable value. Mr. du Plessis, a minister of the Dutch Reformed Church, and a professor in the Stellenbosch Theological Seminary, undertook his journey chiefly to obtain personal acquaintance with the work and progress of the various Christian missions, and it is only when furnished with a broad survey such as is here presented of the activities of the missionaries that it is realized what a profound influence Christian teaching is exercising upon negro Africa. There is no need to follow the author in his distinctions between "Protestants, Catholics, and Anglicans," but the evidence he brings to show that the attitude of the European officers aids Islam to extend and consolidate its influence in the Sudan, especially in Nigeria, deserves careful attention.

After visits to the Gold Coast, Southern Cameroons, and North-West Nigeria, the author went up the Benue to Yola, crossed thence to Fort Archambault on the Shari, and by way of the Ubangi and Welle reached Uganda. He then went to Mombasa, returned to Uganda, and passing by Ruwenzori reached Lake Kivu. By this time the war had begun, and Mr. du Plessis, debarred from entering German East Africa, was allowed to take the military route opened by the Belgians leading west from Kivu to Stanley Falls. Thence he descended the Congo and went to Matadi. Doubling back as far as Kwamouth he ascended the Kasai to Lubeo, whence he struck east overland

to Kongola on the Lualaba. Ascending that stream he reached Katanga, and traversed Northern Rhodesia to Nyasaland, finally reaching Cape Town by the Zambezi and the Beira railway. He had no white companion nor any elaborate outfit, and the safety and comparative ease with which he crossed and recrossed Central Africa indicates the progress made by Europeans in opening up that vast area. The descriptions of the regions visited and the ethnological notes exhibit accurate powers of observation; indeed, the volume might well form an introduction to a closer study of the land and people. One or two points may be noted. On the Uasin Gishu plateau in British East Africa the author discovered "an oval arrangement of stones, suggestive of the elliptical temple at Zimbabwe," and he thinks this discovery may throw light on the problem of the former dwellers on the plateau. At Nyasa he saw marked evidence of the "rapid" shrinkage of the lake-level, and he appears to accept without question the theory of the progressive desiccation of Africa—though his impressions are only those of the passing traveller. Apparently he has not given special attention to the records which tend to show that the levels of the lakes fluctuate with variations in the rainfall. The lack of an index renders it difficult, however, to collate all his statements on any one subject.

The author is well acquainted with the literature of African travel, but he falls into error in stating that H. M. Stanley began his career of discovery when he set out to find Livingstone in 1874. It was in 1871 that Stanley met Livingstone at Ujiji. For the rest, many readers will dissent from the repeated description of Germans as "our Teutonic friends"; but more serious is the labelling of a quotation from "Sally in our Alley" as "that old bit of doggerel"!

F. R. C.

AMERICA

Place-Names in the Rocky Mountains between the 49th Parallel and the Athabaska River.— James White. Reprinted from *Trans. R. Soc. Canada*, 1916, pp. 501–535.

A very useful compilation of place-names in the Rocky Mountains has been made by Mr. James White. The district dealt with is that lying between the Athabasca River and the United States of America. Before the transcontinental railway the Canadian Pacific was opened thirty-one years ago the Canadian Rockies were almost unknown. The first map dealing with the country was Arrowsmith's, 1824. On it are only ten names. The next was that of Dr. Hector in the Palliser journals; in it are to be found many more names of peaks, passes, and rivers, all named by Dr. Hector. It was not, however, until the opening of the railway that the more easy access of the mountains stimulated exploration. Dr. Dawson of the Canadian Survey was first in the field; he added a few names. After him other members of the Survey carried on the work. Since then every year has seen more explorers and climbers, attracted by the numerous unclimbed peaks and untrodden valleys, going farther afield.

It has often been remarked that nearly all the mountains in this district have been named after people; this however is unavoidable, for as far as Indian names are concerned they are conspicuous by their absence. This is due to several reasons; one is that the Stoney Indians had occupied the country only since 1840; moreover, they merely hunted in the mountains for a short time in the year and lived on the plains; another was that they hardly ever attached definite names to mountains or small rivers. Failing Indian names, such nomenclature as Bear Creek, Mirror Lake, Blaeberry Pass was soon exhausted. Again,

as far back as the beginning of last century, all the names given by the people in the employ of the North-West Company to the various posts and to a few of the mountains were the names of people ; it therefore had become a recognized method of procedure.

The list is a very complete one, and in every case where it is possible the name of the author of the name is given, and any other information that may be useful. At the beginning is a short review or sketch of the principal explorations in the Southern Rockies. The author, who was assistant to the late Dr. Dawson during his explorations in the Rockies, has an expert personal knowledge respecting the derivation of many of the place-names, and is to be congratulated on having made a most useful list.

Every year the district dealt with is becoming more popular as a tourist resort, and the author's paper will no doubt save a certain amount of information from being lost. People are always anxious to know why a name is given to any place. Mr. White represents the early days when the Canadian Pacific Railway was just opened to the Rockies ; thirty years ago he was one of the pioneers, and therefore speaks with authority. J. N. C.

GENERAL

Annals of the Royal Society Club : the Record of a London Dining-Club in the eighteenth and nineteenth centuries. Sir Archibald Geikie, O.M., Past President of the Royal Society. 8vo. Macmillan & Co., Ltd. London. 1917. Pp. xv. and 504. 18*s. net.*

The Royal Society Club (not to be confused with the institution in St. James Street which so nearly took its name) has somewhat the same relationship to the Royal Society that the Geographical Club has to our Society ; but with this difference, that whereas the Geographical Club is, so to speak, the second child of the Raleigh Club, the older brother being the Geographical Society, and the parentage duly authenticated by the Raleigh Club records, the Royal Society Club on the other hand, and the Royal Society before it, are descended from the group of philosophers who about 1650 met irregularly in taverns (as Sir Archibald records) and left no documentary evidence to establish the strict descent of their offspring. The Annals now published date from 1743 ; there is no doubt that an organized dining club existed earlier, but it is not clear that the party who from about 1731 dined only on fish and pudding, because Dr. Halley had no teeth, were in any strict sense the forbears of the club. The Annals are nearly complete to the present day, and Sir Archibald Geikie has edited them with scrupulous care, noting the progress of gastronomy, and the embarrassments of Treasurers, and providing many interesting short biographies of the members and their guests. Captain Middleton, an early Arctic explorer, was an original member. An early guest was the Spaniard Don Jorge Juan, who explored the American coast and went with La Condamine to measure the Arc of Peru. General Oglethorpe of the Colony of Georgia ; Clairault of the French Academy's geodetic mission to Lapland ; Bougainville, the Pacific explorer, and alleged author of the plans of Phipps' arctic expedition : Governor Ellis, of North-West-passage fame ; La Condamine himself, who "walked about the streets of London with an ear-trumpet and a map," were all visitors to the Club in its early days ; and we must envy the party who entertained Captain Cook and Joseph Banks on their return in 1771. Not to fail in their duty as experimenters, the Club at various times invited also two Eskimo, the chief Omai of Otaheite, and Thayendanegea,

a Mohawk, but the taste for "what have been called sensational exhibits" did not survive the death of the President of that day, Sir John Pringle.

Major Rennell joined the Club in 1788, the year after his retirement from India. In 1791, when he was only 49, Miss Burney described him as "a gay little wizen old man in appearance, from the eastern climate's dilapidations upon his youth and health"; he lived to be honoured by the resolution of 1829 that he should be in future a permanent member of the Club without reference to his attendance or otherwise, but he died in 1830, just before Captain Franklin, Dr. Richardson, and Sir Edward Parry were entertained. Three of the six members of the Raleigh Club who undertook the formation of the Geographical Society were members of the Royal Society Club—Sir John Barrow, Robert Brown, and Sir Roderick Murchison, as was Admiral Smyth, and all four of our first Vice-Presidents, while the names of many others prominent in Geography appear in the Annals. We learn who induced Sir Roderick to give up hunting and devote himself to science; how Sir John Barrow, who became the Father of the Club, was remembered for his annual motion in favour of economy; and how one of Murchison's guests had passed off the fugitive Louis-Philippe as his uncle, William Smith, the Father of English geology. All who are interested in the great men of our Society will be grateful to Sir Archibald Geikie for his devoted labour in publishing the Annals of the Club in which they played so considerable a part.

THE MONTHLY RECORD

EUROPE

Annual Report of the Director-General, Ordnance Survey.

THE Report of the progress of the Ordnance Survey to 31 March 1917 is necessarily of small dimensions, since the personnel of the survey has been much reduced by the withdrawal of men for the army. It is satisfactory to learn that the new geodetic levelling could be carried on, nine lines of an average length of 24 miles each being completed during the year, bringing the total distance covered up to 2076 miles. The tidal observations at Dunbar and Newlyn, established in connection with the geodetic levelling, have worked satisfactorily, and the mean monthly sea-level at Dunbar for four years and at Newlyn for two are given in tables. The important work of restoring and re-marking the primary and secondary triangulation stations is still in progress, and the transfer of meridians of the large scale-maps is being continued. As this last question is perhaps not widely understood, it may be explained that the large-scale maps of the Ordnance Survey are plotted on Cassini's projection, and that the errors of scale due to this projection become sensible on the map about 75 miles east or west of the central meridian on which the projection is constructed. It follows that the large-scale maps of the country cannot be plotted on a single meridian, for the errors of projection on the eastern and western limits would be intolerable. So for the large-scale map of England twenty different meridians were used, Sussex on the meridian of Ditchling, Surrey of Leith Hill, Middlesex, Herts, and Bedfordshire of St. Paul's Cathedral, Kent of Hollingbourn, and so on. Any sheets would of course fit with adjacent sheets on the same meridian, but a sheet on the western margin of Kent would not fit the adjacent sheet on the eastern margin of Surrey; and this inconvenience was often felt. To some extent it was unavoidable; but it

can be very much lessened by the scheme of transfer now in operation, which reduces the meridians of England from twenty to seven; thus all the counties mentioned above, with Essex, Cambridge, Huntingdon, Norfolk, and Suffolk, will be plotted on the meridian of St. Paul's, four superfluous meridians and four causes of misfit being thus abolished. The work will necessarily take many years; but its regular progress is now assured, and this is especially gratifying in view of the fact that the reform was on a previous occasion declared quite impracticable, on a pessimistic estimate of the time and expense involved.

ASIA

Steam Navigation on the Upper Yang-tse.

As is well known, the Yang-tse is navigable by large vessels up to Ichang, 1000 miles from its mouth, immediately above which begins the formidable series of rapids which long proved an insuperable obstacle to steam navigation, but which were at length successfully surmounted through the persevering efforts of Mr. Archibald Little, whose steamer the *Pioneer* passed the gorge, and reached Chung-king in 1900, repeating the voyage shortly afterwards (see *Journal*, vol. 18, p. 498). An attempt to ascend the gorges in winter made by the German steamer *Sui-hsiang* in December 1900 proved disastrous, and for some years little was done to inaugurate regular steam traffic on the upper river, the *Pioneer* having been sold to the British Admiralty and converted into a gun-vessel under the name *Kinsha*. Within the past few years a decided step in advance has been made, and interesting information on the present state of affairs is given in the *Bulletin Economique de l'Indo-Chine* (published officially in Tong-king) by Captain P. A. Lapicque, who traces from the beginning the various efforts to open the upper river to commerce by modern means of transport. The success achieved is principally due to Captain Plant, who commanded the *Pioneer* in 1900, piloted the French war-vessel *Olry* on her voyage in 1901, and whose knowledge and experience of the difficult navigation of the gorges is unrivalled. In 1908 he organized a Chinese company (the Se-chuan Navigation Company) for the navigation of the river, and a twin-vessel (tug and lighter) was built on his plans in 1909 at Southampton. This proved not altogether satisfactory, and a return to the single type of vessel was made with the *Phu-hun*, built at Glasgow in 1914. During that year and the two following ten other vessels have been built for various owners, mostly at Shanghai, one sailing under the British, the rest under the Chinese flag. In spite of difficulties with engines and other drawbacks a regular service seems to have at last been established, the steamers plying during two-thirds of the year, and making their terminus Sui-fu (or even Kia-tung), considerably above Chung-king. The voyage can be made without interruption from mid-April to the end of October, and occasionally up to the end of December. In winter, when the water is low, navigation would be possible only in three separate sections. The voyage occupies normally six days in the upward and two in the downward direction. The opinion is held by some that when the railway now under construction past the rapids is completed—and there is no saying when that will be—there would be no scope for steam river-traffic. But Captain Lapicque thinks that, for merchandise, steamers could always compete successfully with the railway. He urges that the success attained on the Yang-tse should encourage further efforts for the introduction of steam navigation on the Mekong in French Indo-China.

AFRICA

Colonel H. G. C. Swayne's Maps of Somaliland.

Colonel H. G. C. Swayne, R.E., has recently presented to the Society a complete set of maps showing the route surveys and explorations in Somaliland made by himself and his brother Lieut. (now Brig.-General) E. J. E. Swayne during the years 1892-93. The map is in eight sheets on the scale of 1 inch to 4 miles, photozincographed at the offices of the Survey of India, Calcutta, from the two brothers' original drawings. It makes an important addition to our map collection, for the ground is not quite covered by any published map on this scale. The routes extend from the Somali coast between Zeila and Karam, some 50 miles east of Berbera, to the south, south-east, and south-west as far as about latitude 8° N. The survey was made with care under considerable difficulties, largely by latitude and azimuth traverses, filled in with compass routes. Much detailed topography is shown along the routes, and the general execution of the sheets is remarkably good. In 1892 Somaliland was practically unmapped, and south of Berbera we had only the slight route sketches of the brothers James of the few somewhat later British and Italian travellers who had begun to penetrate the interior. Thus the surveys shown on the sheets presented by Colonel Swayne were of great importance at the time they were made; and indeed a comparison of them with the latest sheets of the 1/250,000 War Office map shows that for a great part of the country, especially to the south-west, they still constitute the principal, if not the only material for the map; though in some parts of the country, especially in the neighbourhood of and to the south of Berbera, much new survey has been made in recent years by Captain Beazeley and others in the course of military operations. Colonel Swayne's maps bore for many years the "Confidential" stamp of the Government of India, and might not be mentioned in this Journal; while the absence of any list of authorities on the War Office 1/250,000 map, and the statement on the 1/M map published 1901 (I.D.W.O. 1539) that "no portion of the country included in this sheet has been surveyed," have naturally but unfortunately conspired to hide the very considerable credit due to Colonel Swayne for his work of twenty-five years ago.

AMERICA

A Decade of the Salton Sea.

Under this title Dr. D. T. MacDougal, the well-known Director of the Desert Laboratory of the Carnegie Institution at Tucson, Arizona, gives an interesting sketch of the phenomena observed during the ten years following the inundation of the Cahuilla basin by the Colorado river. That inundation, due to breaches in the banks of the lower Colorado at times of exceptional flood, resulted, it will be remembered, in the formation of a greatly enlarged "Salton Sea"—as the lake occupying the lowest part of the basin is named—which in 1907 reached an area of from 450 to 500 square miles, with a depth of from 80 to 85 feet. In that year the efforts of the engineers to repair the breaches were at last successful, and the area of the lake has since diminished till it now stands at less than 300 square miles, with a depth of little more than 30 feet, and before long the area will be brought down to about 206 square miles, when alternate fillings and losses by evaporation will give it the character of an oscillating lake. Dr. MacDougal begins by referring to its past history, which is somewhat obscure, though the evidence indicates that three or four centuries have elapsed since the water rose in the basin to the highest level, and this is thought by some to have been the case but once in

its history. After complete filling, should the basin receive nothing but the drainage of the surrounding slopes, nearly a century would elapse before, under the excessive evaporation of this markedly desert area, it dried up, leaving the white saline beds on its bottom. The probable course of recession would be a halting one, with many partial returns towards the maximum level and a few actual refillings. Either in one or several periods the lake stood full, or nearly so, sufficiently long for the organic formation of a travertine layer one to three feet in thickness. Its irregular recession is well recorded in a series of terraces or benches, 83 of which have been counted at one spot within 200 feet of gravelly slope near the Salton railway station. The discovery of a series of native rock-carvings made in the travertine and in no case reaching the underlying granite throws some light on the past history, some of the carvings having been coated over during subsequent rises of the water. None have been made in the present surface of the travertine. Dr. MacDougal's observations have been largely concerned with the effects of the recent fluctuations of level on the vegetation, the studies of the repeopling of the land left bare by the retreat of the water having been unusually careful and detailed. With the influx of the waters the seeds of a large number of land and shore plants from along several hundred miles of the Colorado river, besides others floated from the dry slopes of the basin, were brought in, and the strip which emerged first, having been washed by the water in its freshest stage, was quickly covered with a dense belt of vegetation, much as if the lake were of fresh or only brackish water. With the increasing concentration of the salts—the subject of careful observation year by year—the successive shore-lines were less richly sown each year, until now only five species gain a footing on the beaches. Another interesting feature is the rapid change in the plant-components of the individual belts of vegetation with increasing dryness, to which the fresh-water pioneers quickly succumbed. Particularly instructive are the observations of the re-peopling of the shore of a volcanic hill virtually covered by the highest flood, and since left as an island separated from the mainland by 6 or 7 miles of water. In 1908 two individuals, of two species, made their appearance; in 1912 these had increased to 33 individuals, of six species; and in 1916 to 470 individuals, of 10 species. The transport of the seeds seems to have been brought about by the winds or water, and no well-proved case of transport by birds was found. A hitherto undescribed mode of dissemination seems to be that by the flotation of *seedlings*, which have germinated in the water and take root upon stranding. The mass of material recently brought into the basin by the Colorado is thought to have amounted to about one-third of a cubic mile—about one-twelfth of the total volume of the present lake. The paper, which appears in the *Geographical Review* for June 1917, is illustrated by excellent photographs and by a sketch-map showing the changing outlines of the lake.

New Boundary between the States of Paraná and Santa Catharina, Brazil.

A long-standing dispute touching the boundary between these two states was finally settled by an agreement ratified on October 20, 1916, by which a compromise appears to have been effected between the extreme claims of the two parties. The new line of frontier is described in the October number of the *Geographical Review*, p. 318. In the east it coincides with the long-accepted boundary, which follows the Rio Negro to its confluence with the Iguassú. Thence it crosses by the bridge of the São Paulo—Rio Grande railway and follows this line to the junction of the branch to Palmas, which is in turn followed as far as the Rio Jangada. Following this river to its

source, the line strikes due west to the water-parting, and follows this to the line connecting the sources of the San Antonio and Peperiguassú rivers, close to the Argentine frontier. The line can be followed on a map of the State of Paraná by Romario Martins, published in 1913. That state is shown on this map as extending south (in its western part) to the Upper Uruguay, whereas most maps have hitherto allocated the whole area between the Uruguay and Iguassú to Santa Catharina. The water-parting which is now adopted in this section runs about midway between the two rivers.

New American Scientific Expedition to Peru.

Mr. Philip A. Means, already known as an authority on the early history and antiquities of Peru, left New York early in October to carry on a scientific investigation on behalf of the United States and Peruvian governments. He will study the racial, economic, and geographical conditions in the little-known provinces of Piura and Ayavaca in the extreme north, and also in those of Arequipa, Lima, and Cuzco further south. The expedition has the support of the Smithsonian Institution and two other learned bodies.

POLAR REGIONS

The Macmillan Expedition.

The safe return south of the relief ship *Neptune* with the members of the Crocker Land expedition was announced in the October number. According to a note in the *Geographical Review* (October, p. 320) the voyage from Etah took twenty-two days. Southerly winds had packed Smith Sound and Melville Bay, and the ship was leaking badly on arrival from the hammering of the ice. During the spring of 1917 Prof. Macmillan had carried out two trips from Etah to the south-east coast of Ellesmere Island, and was able to correct various minor inaccuracies in existing maps, based on surveys from the decks of vessels. At the northern entrance to Baird Inlet remains of Greely's Starvation Camp were visited, and near Cape Isabella (78° 20′ N.) records left by Sir G. Nares were found, as well as a mail left for his expedition by Sir Allen Young in the *Pandora*. On the second trip a very large glacier was discovered between Paget Point and Cape Faraday (77° 40′ N.), and was named American Museum Glacier. Throughout this region glacial activity has increased since the middle of the nineteenth century. Good observations for latitude, longitude and azimuth were obtained at all salient points.

GENERAL

Human Regions.

An interesting article on this subject, which all geographers may read with profit, is contributed by Dr. Fleure to the May number of the *Annales de Géographie*. It is a further development of the ideas expressed in a lecture to the Geographical Association in January 1917, published in the spring number of the *Geographical Teacher* for that year. In the present article geographical regions are treated from a somewhat novel point of view, but hardly so new as Dr. Fleure would seem to think. He seems to believe that in making man the starting-point of his classification of regions he is doing something that has not been thought of before. He regards Herbertson's regions based on the characteristics of climate and relief as one leaving out of account the nature of human activity, and tending to beget the idea that man is merely the creature of circumstances, the product of his environment. But this contention cannot be made good. In such classifications as that of Herbertson man with all his powers is always tacitly understood, and the geographical conditions are merely

put forward as favouring or hindering him in his work. And so it is with the classification now suggested by Dr. Fleure, even though we may recognize a useful novelty in the principle of that classification. Human energy, Dr. Fleure tells us, tends to accomplish three essential things—nutrition, reproduction, and the increase of well-being. Without the first two every race would become extinct. There remains therefore, as the basis of classification of human regions, the third function, the increase of well-being From this way of putting his case one might suppose that Dr. Fleure was confounding the geographical with the sociological point of view, making human action rather than the theatre of human action the fundamental subject of consideration. But it is not so. His proposed classification of regions is essentially geographical, being one into regions distinguished according to the degree in which they tend to further or to thwart man's efforts to increase his own well-being. And when this is observed it will be seen that after all the main detriments of this classification are the same as with Herbertson, climate and relief, as may be seen from the table on p. 169, in which he enumerates his six classes of regions, and in which the second column gives the physical characteristics of the several regions, characteristics falling in every case under the two heads mentioned. The six classes are: (1) Hunger Regions, either regions of extreme cold or isolated deserts; (2) Region of Nomadism, with great variations of temperature and periods of drought; (3) Regions of Lasting Difficulty, including high valleys of the temperate zone and plateaux with a cold winter; (4) Regions of Effort, with moist winds and not excessive temperatures; (5) Regions of Increase of Well-being, including those with a Mediterranean type of climate, a moderate monsoon climate, the climate of oases not too far away from other rich countries, and the climate of countries at a sufficient height in the hot zones; and (6) Regions of Debilitation, those with equatorial rains together with islands of excessive heat. One objection that might be made to this scheme (and no scheme, we are confident, could be devised without the possibility of taking exception to it on some ground) Dr. Fleure anticipates by observing (p. 170) that the limits of those regions must not be drawn too exactly. They run into one another in their zones of contact, and the idea of a zone of contact is in fact more fruitful than that of a frontier line. A more serious objection might be raised on the ground that the character of a region as favouring or hindering human well-being is largely modifiable by man's own action, whether deliberate (as Dr. Fleure himself points out) or unconscious. It makes, for instance, a great difference in this respect whether an area is made to produce the greatest quantity of raw produce per head or per acre, and in some cases the unconscious result of man's own action is to leave no choice, as where land in an agricultural region is too minutely subdivided. But this consideration does not take away the value of Dr. Fleure's point of view in classification. We rather get an illustration of its value in suggesting questions of this sort. In speaking of the actual regions to be adopted, not the classes, Dr. Fleure points out that the extent of the area to be so defined must be taken account of. A human region, he states (p. 172), is a part of the surface of the Earth which possesses sufficient unity and at the same time sufficient variety to be properly so designated. An area of great extent is unlikely to have the necessary unity; one too small, the necessary variety. Almost all European states are too large, while communal or parochial units are too small. He suggests that a university would form the appropriate centre of any well-defined human region, and at the close of the article he gives an interesting account of what is being done by the University of Wales to study the region belonging to it. G. G. C.

The Cortes Society.

To the growing list of societies concerned with the publication of rare or not easily accessible documents relating to the history of geographical discovery must now be added the Cortes Society, lately founded in America. The Hakluyt Society in this country may be said to have set the example in this sphere of work just seventy years ago, but only of recent years has it found imitators in the Champlain Society of Canada, the Linschoten Society of Holland, and in the Humboldt Society projected in Germany just before the war. Other societies, such as the Navy Records Society in this country and the Prince Society in America, have only partially covered the same ground. The new society (of which the president is the well-known ethnologist Frederick Webb Hodge, and the Secretary Prof. Marshall H. Savile) will concern itself with the shorter narratives and *relaciones* dealing with the conquest of America and with its peoples, which have never appeared in English, thus avoiding conflict with the Hakluyt Society. The first two issues—translations of the works of the anonymous conqueror of Mexico and of Pedro Sancho's report on the partition of Atahualpa's ransom, by Prof. Saville and Mr. P. A. Means respectively, are already in the press. The subscription is $5 yearly.

Gilchrist Studentship.

The Gilchrist Educational Trust will offer in February a studentship in Geography of the value of £80 for one year. The student elected must undertake a course of study at some recognized School of Geography. The Committee will be prepared to consider an application from the successful candidate for leave to postpone the benefits of the studentship until after the war. Applications with testimonials and references should be sent not later than 1 February 1918 to Prof. Lyde, University College, London, W.C.

Erratum.

In Mr. Harding King's paper, *G.J.*, November 1917, p. 359, fourth line from bottom : a Sahm is a third (not a sixth) of a Tumn.

OBITUARY

Brigadier-General C. G. Rawling, C.M.G., C.I.E.

Of the many gallant officers whom the Society has lost from its fellowship by death in action none will be more sincerely regretted than Brigadier-General Cecil Godfrey Rawling, C.M.G., C.I.E., who was killed on October 28 by a shell as he was standing outside his Brigade Headquarters on the western front. A few months ago the Society was proud to include him in the list of its Gold Medallists, and they looked forward with high hope to the time when he should be able to return to the work of geographical exploration on which he was so keen and in which he had such important plans for the future.

General Rawling was a Devonshire man, born in 1870 and educated at Clifton. He joined the army in 1891, and was gazetted to the Somerset Light Infantry, the famous old 13th Regiment. A great part of his service was abroad. His geographical work began in 1902, when he made a tentative crossing of the Lanak La into Tibet with such success that in the following year he started on a more ambitious though unauthorized expedition with

Lieut. (now Major) Hargreaves, of the same regiment. With a party of twenty-five followers and a caravan of forty ponies and yaks they crossed once more the Lanak La and explored and surveyed Western Tibet and Rudok, mapping about 38,000 square miles of hitherto unmapped country, for which service they received the thanks of the Government of India. This naturally led to employment with the Lhasa expedition, for which he eventually received the medal and clasp. On the way back from Lhasa he was detached at Gyantse and led the party which travelled west along the north of Nepal through Gartok to Simla, establishing the fact that there is no mountain higher than Mount Everest in that part of the world. It is no secret that had it not been for official objections he would have turned to advantage the knowledge obtained on that expedition, and have undertaken the exploration of the approaches to Mount Everest from the north, the line which appears to offer the most favourable access to this quite unknown region.

After brief service in England Captain Rawling, as he still was, went with an expedition, largely ornithological, to Dutch New Guinea, and in that most difficult country he showed to the full his great powers of leadership in adversity. When the chief of the expedition was invalided he took over the responsibility at a critical time, and brought back results which were not only a considerable contribution to our scanty knowledge of that part of the island and of its interesting pigmy inhabitants, but which showed the way for the more fortunate expedition of Dr. Wollaston which followed. For his work in New Guinea he received the thanks of the Dutch Government.

At the outbreak of war in August 1914 he was ordered to raise and train a service battalion of his regiment, which he subsequently commanded in France. The gifts of command which he had developed in distant exploration very naturally led to success in the field as Colonel of his regiment, to the award of the C.M.G., and to promotion to the rank of Brigadier-General. In command of his brigade he had passed through much of the most terrible fighting in the struggle on the Somme and later around Ypres. His friends record that his true courage, modesty, and kindness of heart were as conspicuous in the fight as they had been in the Himalaya or New Guinea. While we were proud of his success in the field, he himself whenever he came back on short leave from the front was thinking and talking always of a plan to conquer Everest in which he had enlisted the help of several tried mountaineers and hardy travellers. After the war there should be no political difficulties to hinder the approach from the north, and we hope that one of the first enterprises to be undertaken when the immediate demands of the war have ceased will be the equipment of an expedition by Rawling's friends and colleagues to carry him with them in memory to the great mountain which he hoped himself to climb.

The *Times* of November 7 contained an appreciation of General Rawling signed "J. B." from which we take leave to quote the last paragraph, with thanks to the author for expressing so well what many of his friends in the Society are feeling.

"To those who knew him Cecil Rawling will always seem the *beau ideal* of a British soldier. He had no taste for heroics or fine talk; but he had a heart as tender as a woman's, and a loyalty in friendship as impulsive as a boy's. Indeed, he had the eternal boyishness of the Elizabethans, for the world to him was so full of fine things to do that his only regret was the necessity of choosing one and discarding others. His patient courage, his resourcefulness, his constant humour and cheerfulness, his simplicity, were, in the form he possessed

them, essentially English. . . . Everything he had to do, whether in exploration or soldiering, he did supremely well, but without parade. He has rounded off a full and most honourable life with the kind of death which was a fitting close to such a record. Perhaps he had achieved both of his ambitions, for in the long sacrifice and endurance of the great war he scaled higher peaks than Everest."

Brigadier-General Malcolm Peake, C.M.G., R.A.

We record with great regret the death in action on August 27 of Brigadier-General Malcolm Peake, C.M.G., R.A., who had been a Fellow of the Society for thirteen years. He had passed much of his service with the Egyptian army, taking part in the Dongola Expedition of 1896 and the Nile Expedition of 1898, and commanding the Egyptian artillery at the battles of Atbara and Omdurman. In 1899 he was sent in command of the expedition to clear the sudd from the upper reaches of the White Nile, and succeeded in opening the river for navigation, for which service he was given the C.M.G. During the first two years of the war he was engaged in organizing the artillery of the new armies, but in April 1916 went to France in command of the artillery of a division, being promoted later to command the artillery of a corps.

Captain J. H. Miller.

We regret to record the death of Captain J. H. Miller from blackwater fever in Alexandria. Although Captain Miller was only thirty-four years of age, he had had very considerable experience in many parts of the world, for since 1905 he had been travelling almost continually. His main object was the search for big game, yet he did much besides; he was a keen observer and collected many specimens for scientific institutions. After a summer spent in Iceland he joined Mr. Douglas Carruthers in Syria in 1905, and made large collections of birds and mammals in the Syrian desert and at Petra. In 1906 he was hunting in the interior of Asia Minor. In 1908 he travelled across Siberia and Turkestan, hunting in the Altai and the Tian Shan Mountains. In 1910–11, in company with Messrs. Carruthers and Price, he took part in an expedition, extending over twenty months, in Mongolia and Turkestan. He collected many interesting zoological specimens on this journey, and formed a remarkable collection of the big game of Central Asia. In 1913 he visited the Red Sea Province, and in the winter of 1913-14 he was hunting with Mr. P. H. Thomas in Southern Abyssinia on the Somali borderlands. His collection included many notable trophies, and he was considered a very fine shot. One of the original Expeditionary Force in France, he was wounded in the battle of the Marne. On recovery he was attached to the Egyptian army, and was in charge at Kajo Kaji, in the Mongalla Province. Even here, in spite of heavy duties, he started to work on the ornithology of the surrounding country, and made great plans for the future. While on leave in Alexandria he suddenly developed blackwater fever and died on August 26.

CORRESPONDENCE

The South Sea Oracle.

In the interesting discussion on Easter Island I find on p. 344 of the *Geographical Journal* an account of a custom (taken from Melville's 'Typee') where the priests whisper into the ears of an idol-god and receive oracles that they

then communicate to the people. The accounts of the slaughter of the Spaniards in the North of British Honduras by the Santa Cruz Indians describe a similar proceeding. The chiefs (who appear to have also been the priests) certainly consulted the idol, whispering into its ear, and then giving forth the oracle.

Obsidian blades sharp as razors are very commonly found in British Honduras, but whence they get the jade for their carved figures has not been ascertained.

E. J. E. SWAYNE.

Peronne, 5 November 1917.

GEOGRAPHICAL LITERATURE: ADDITIONS TO THE LIBRARY. Edward Heawood, Librarian, R.G.S.

For list of abbreviations see January number.

EUROPE

Alps—Orography. *Z.G.E. Berlin* (1916): 602–623, 675–687. **Machatschek.**
Verebnungsflächen und junge Krustenbewegungen im alpinen Gebirgssystem. Von Fritz Machatschek.

Austria—Dalmatia—Italians. *Riv. G. Italiana* 24 (1917): 132–147. **Dainelli.**
Quanti sieno gli Italiani in Dalmazia. By Giotto Dainelli.
The author analyses the official returns, and comes to the conclusion that they greatly under-rate the number of Italians in Dalmatia.

Balkan Peninsula—Historical. **Ricchieri.**
B.R.S.G. Italiana, Ser. V., 6 (1917): 401–435.
Il fato geografico nella storia della penisola balcanica. By Giuseppe Ricchieri. *Sketch-maps.*

Balkans—Nationality. **Seton-Watson.**
The rise of nationality in the Balkans. By Dr. R. W. Seton-Watson. London: Constable & Co., 1917. Size 8½ × 5½, pp. viii. and 308. *Maps. Price* 10*s.* 6*d. net. Presented.*

Belgium—Antwerp. *G.Z.* 23 (1917): 33–40. **Kretschmer.**
Antwerpen. Von K. Kretschmer.

Bosphorus and Dardanelles—Political. **Phillipson and Buxton.**
The question of the Bosphorus and Dardanelles. By Dr. Coleman Phillipson and Noel Buxton. London: Stevens & Haynes, 1917. Size 10 × 6, pp. xvi. and 264. *Price* 12*s.* 6*d. net. Presented.*

Carpathians. *G. Rev.* 3 (1917): 417–437. **Martonne.**
The Carpathians: Physiographic features controlling human geography. By Emmanuel de Martonne. *Maps, Sketch-maps and Illustrations.*

Central Europe—Waterways. *G.Z.* 23 (1917): 62–78. **Hennig.**
Das mitteleuropäische Binnenschiffahrtsnetz und die Möglichkeit seiner Ausgestaltung nach dem Kriege. Von Richard Hennig.

Europe—Communications. *G.Z.* 23 (1917): 1–9. **Dix.**
Das verkehrsgeographische Grundproblem des Weltkrieges. Von Arthur Dix. *Sketch-map.*

Europe—Historical—Cassiterides. *G.Z.* 23 (1917): 216–220. **Beckers.**
Die Lage der Zinneninseln des Altertums. Von W. J. Beckers.

Europe—Political. *Riv. Coloniale* 12 (1917): 237–249, 339–360. **D'Alia.**
Le basi nazionali della Nuova Europa. By A. D'Alia. *Map.*

Europe—Political. **Egerton.**
British foreign policy in Europe to the end of the nineteenth century. A rough outline. By H. E. Egerton. London: Macmillan & Co., 1917. Size 7½ × 5, pp. x. and 440. *Price* 6*s. net. Presented.*

Europe—War. *Riv. G. Italiana* 24 (1917): 111–131. **Musoni.**
Cause ed aspetti, specialmente geografici, dell' odierno conflitto europeo. By Francesco Musoni.

France—Etang de Berre. *Ann. I. Océanogr.* 7 (1916): fasc. 4, pp. 90. **Chevallier.**
L'Etang de Berre. Par A. Chevallier. *Illustrations and Map.*

France. **Vidal de la Blache.**
P. Vidal de la Blache. La France de l'Est. (Lorraine-Alsace.) Paris: Armand Colin, 1917. Size 10 × 6½, pp. x. and 280. *Maps. Price* 8*s.* 6*d. Presented.*
An important work on the geographical basis of the history of France's eastern borderlands.

Greece—Salonika. *National G. Mag.* 30 (1916): 203–232. **Dwight.**
Saloniki. By H. G. Dwight. *Illustrations.*

Greece. **Frazer.**
Studies in Greek scenery, legend, and history. Selected from his commentary on Pausanias' 'Description of Greece' by Sir James George Frazer. London: Macmillan & Co., 1917. Size 7½ × 5, pp. x. and 420. *Price* 5*s. net. Presented.*
An exact reprint under a new title of 'Pausanias and other Greek Sketches,' which appeared in 1900 (see *Journal*, vol. 16, p. 571). Most of the articles, including the first and longest, are extracted from the same author's translation of and commentary on the Greek geographer Pausanias, published in six volumes in 1898. They give a vivid idea of Greek scenery and characteristics, and the reprint is sure to be widely welcomed.

Hungary—Transylvania—War zone. *G.Z.* 23 (1917): 257–267. **Sölch.**
Die siebenbürgische Kriegsschauplatz. Von Johann Sölch.

Poland—History. **Whitton.**
A history of Poland from the earliest times to the present day. By Major F. E. Whitton. London: Constable & Co., 1917. Size 8½ × 5½, pp. 302. *Maps. Price* 8*s.* 6*d. net. Presented.*

Scandinavia—Lapland. **Butler.**
Through Lapland with skis and reindeer, with some account of ancient Lapland and the Murman coast. By Frank Hedges Butler. London: T. Fisher Unwin, [1917]. Size 9 × 5½, pp. x. and 286. *Portrait, Map and Illustrations. Price* 12*s.* 6*d. net. Presented.*

Turkish Empire—Historical. **Eversley.**
The Turkish Empire. Its growth and decay. By Lord Eversley. London: T. Fisher Unwin, [1917]. Size 9 × 5½, pp. 392. *Maps. Price* 12*s.* 6*d. net. Presented.*

United Kingdom—Bedfordshire. **Chambers.**
Cambridge County Geographies. (Edited by F. H. H. Guillemard.) Bedfordshire. By C. Gore Chambers. Cambridge: University Press, 1917. Size 7½ × 5, pp. x. and 196. *Illustrations and Diagrams. Price* 1*s.* 6*d. net. Presented.*

United Kingdom—Kent—Early map. **Cock.**
The oldest map of Romney Marsh. By Dr. F. William Cock. (From 'Archæologia Cantiana,' vol. 30.) London: M. Hughes & Clarke, 1913. Size 8½ × 5½, pp. 8. *Facsimiles. Price* 6*s.*

United Kingdom—Kent—Early map. **Hannen.**
An account of a map of Kent dated 1596. By the Hon. Henry Hannen. (From 'Archæologia Cantiana,' vol. 30.) London: M. Hughes & Clarke, 1913. Size 8½ × 5½, pp. 10. *Facsimile. Price* 6*s.*

ASIA

Arabia—Political. *G.Z.* 23 (1917): 197–215. **Schmidt.**
Der Kamp um Arabien zwischen der Türkei und England. Von Walther Schmidt.

Armenia. **Hacobian.**
Armenia and the war. An Armenian's point of view, with an appeal to Britain and the coming peace conference. By A. P. Hacobian, with a preface by the Right Hon. Viscount Bryce. London: Hodder & Stoughton, 1917. Size 7½ × 5, pp. xviii. and 200. *Price* 2*s.* 6*d. Presented.*

China—Historical. **Parker.**
China. Her history, diplomacy, and commerce, from the earliest times to the present day. By E. H. Parker. 2nd edit. London: John Murray, 1917. Size 9 × 5½, pp. xxx. and 420. *Maps. Price* 10*s.* 6*d. net. Presented.*
The first edition came out in 1903.

China—Sport. **Sowerby.**
A Sportsman's Miscellany. By Arthur de Carle Sowerby. Tientsin: Tientsin Press, 1917. Size 9½ × 7½, pp. 226 and viii. *Illustrations. Presented.*
The author has had considerable experience of travel in Northern China, and was joint-author with R. S. Clark of 'Through Shên-kan' (1912), reviewed in vol. 41, p. 276. The present sketches are less serious in aim, but are brightly written and give much interesting information on the wild life of various parts of China.

Himalaya. **Workman.**
Two summers in the ice-world of Eastern Karakoram. The exploration of 1900 square miles of mountain and glacier. By Fanny Bullock Workman and Dr. William Hunter Workman. London: T. Fisher Unwin, 1917. Size 9½ × 6½, pp. 296. *Maps and Illustrations. Price* 25*s. net. Presented.*

Japan—Structure. **Yabe.**
Sc. Repts., Tohôku Imp. Univ., 2 Ser. Geology 4 (1917): 75–104.
Problems concerning the geotectonics of the Japanese islands; critical reviews of various opinions by previous authors on the geotectonics. By Hisakatsu Yabe. *Maps.*

Japan—Usu eruption. *J. Geology* 25 (1917): 258–288. **Oinouye.**
A few interesting phenomena on the eruption of Usu. By Y. Oinouye. *Illustrations and Map.*

Russia—Siberia—Ethnology. *Scottish G. Mag.* 33 (1917): 289–303. **Czaplicka.**
On the track of the Tungus. By M. A. Czaplicka. *Illustrations.*

Tibet—Geology. **Douvillé.**
Mem. Geol. Surv. India, Palæont. Indica, New Series, 5 (1916): pp. iii., 52.
Le crétacé et l'éocène du Tibet Central. By Henri Douvillé. *Illustrations.*

Turkey—Bagdad—Climate. *B.R.S.G. Italiana*, Ser. V. 6 (1917): 436–444. **Eredia.**
Sul clima di Bagdad. By Filippo Eredia. *Illustration.*

AFRICA

Abyssinia—Expedition. **Léontieff.**
Provinces équatoriales d'Abyssinie. Expédition Dédjaz Comte N. de Léontieff. Paris, N.D. *Illustrations and Map.*

Algeria—Anthropogeography. *Ann. G.* 26 (1917): 219–228. **Bernard and Doutté.**
L'habitation rurale des indigènes de l'Algérie. Par Augustin Bernard et Edmond Doutté. *Map.*

Belgian Congo—Economic. *J.R.S. Arts* 65 (1917): 369–390. **Horn.**
The economic development of the Belgian Congo. By M. Horn.

Central Africa—Lake Bangweulu. *J. African S.* 16 (1917): 216–226. **Crabtree.**
Lake Bangweulu and its inhabitants. By W. A. Crabtree. *Illustrations.*

Central Africa. **Plessis.**
Thrice through the Dark Continent. A record of journeyings across Africa during the years 1913–16. By J. du Plessis. London: Longmans, Green & Co., 1917. Size 9 × 6, pp. viii. and 350. *Map and Illustrations. Price* 14*s. net. Presented.*
See Reviews, *supra*, p. 455.

German East Africa. **Calvert.**
German East Africa. By Albert F. Calvert. London: T. Werner Laurie, 1917. Size 7½ × 5, pp. xx., 122, and 219. *Plates of Maps, Diagrams and Illustrations. Price* 6*s. net. Presented.*

German East Africa. **Spanton.**
In German Gaols. A narrative of two years' captivity in German East Africa. By Ernest F. Spanton. With a prefatory note by Sir Harry H. Johnston. London: Society for Promoting Christian Knowledge, 1917. Size 7½ × 5, pp. xii. and 112. *Illustrations. Price* 2*s.* 6*d. net. Presented.*

Records in some detail the harrowing experiences of British Missionaries under the brutal treatment meted out to them by the German authorities. It affords a clear insight into German methods, and must be read by all interested in the future of what has been German East Africa.

German East Africa—Climatology. *Q.J.R. Meteor. S.* 43 (1917): 175-195. **Lyons.**
Climatological studies. German East Africa. By Major H. G. Lyons. *Illustrations and Map.*

Nigeria—Kanuri grammar. **Duisburg and Benton.**
Primer of Kanuri grammar. (Translated and revised from the German of A. von Duisburg.) By P. A. Benton. London: H. Milford, 1917. Size 7 × 4½, pp. 130. *Price 6s. net. Presented.*

Mr. Benton's own contributions to Sudan Linguistics and history (cf. *Journal*, 40, p. 633; 43, p. 685) have made him specially qualified to carry out the revision and editing of this work. He is frequently able to correct the opinions of the original author on minor points.

Nyasaland—Missions. **Mills.**
What we do in Nyasaland. Compiled by Dora S. Yarnton Mills. London: Universities' Mission to Central Africa, 1911. Size 7½ × 5, pp. xii. and 266. *Sketch-maps and Illustrations. Presented.*

South Africa—Historical. **Theal.**
History of Africa South of the Zambesi from the settlement of the Portuguese at Sofala in September 1505 to the conquest of the Cape Colony by the British in September 1795. By Dr. George McCall Theal. Vol. I. The Portuguese in South Africa from 1505 to 1795. 3rd edit. Carefully revised and enlarged. London: G. Allen & Unwin, [1917]. Size 9 × 6, pp. xxii. and 546. *Maps and Illustrations. Price 7s. 6d. net. Presented.*

South Central Africa—Travel. **Goold-Adams.**
Queensland G.J. 30-31 (1914-1916): 35-64.
South-Central Africa: a narrative of personal travel and experiences. By Sir Hamilton Goold-Adams. *Illustrations and Maps.*
An address on the 30th Anniversary of the Queensland Geographical Society.

NORTH AMERICA

America—Discovery. **Alexander.**
Cambridge Travel Books. The discovery of America, 1492-1584. Edited by Philip F. Alexander. Cambridge: University Press, 1917. Size 8 × 5½, pp. xviii. and 212. *Sketch-maps and Illustrations. Price 3s. net. Presented.*

A welcome addition to this series, describing some of the important episodes in the Discovery of America in the form of extracts from the original records.

Canada—Ontario—Geology. **Johnston.**
Canada, Geol. Surv., Museum B. No. 23 (1916): pp. 22.
The Trent valley outlet of Lake Algonquin and the deformation of the Algonquin water-plane in Lake Simcoe district, Ontario. By W. A. Johnston. *Illustrations and Map.*

Canada—Rocky mountains—Place-names. **White.**
Place-names in the Rocky Mountains between the 49th parallel and the Athabaska River. By James White. (From *Trans. Roy. Soc. Canada*, Sect. II., 1916.) Ottawa, 1916: Size 9½ × 6½, pp. 501-536. *Presented.*
See review, *supra*, p. 456.

United States—Salton Sea. *G. Rev.* 3 (1917): 457-473. **MacDougall.**
A decade of the Salton Sea. By D. T. MacDougall. *Illustrations and Sketch-map.*
See Monthly Record, *supra*, p. 460.

United States—Tornadoes. *Q.J.R. Meteor. S.* 43 (1917): 317-329. **Ward.**
The tornadoes of the United States as climatic phenomena. By Robert de C. Ward. *Maps and Illustrations.*

United States—Vegetation. *G. Rev.* 3 (1917): 119-125. **Shreve.**
A map of the vegetation of the United States. By Forrest Shreve. *Map.*

CENTRAL AND SOUTH AMERICA

Central America and U.S. *G.Z.* 23 (1917) : 177-197. **Sapper.**
Die amerikanischen Mittelmeerländer und die Vereinigten Staaten. Von Karl Sapper.

Chile.
Chile. Published by the Chilean Government. Santiago, 1915. Size 10 × 7, pp. 302. *Sketch-maps and Illustrations. Presented.*

Honduras. **Cálix.**
Geografía de Honduras. By Ulises Meza Cálix. Tegucigalpa, 1916. Size 11 × 8, pp. 180.

South America—Political. *G.Z.* 23 (1917) : 9-32. **Steffen.**
Der Panamerikanismus und die südamerikanischen ABC-Staaten. Von Hans Steffen.

AUSTRALASIA AND PACIFIC ISLANDS

New Guinea—Aerial Expedition. *G. Rev.* 3 (1917) : 89-106. **Mjöberg.**
A proposed aerial expedition for the exploration of the unknown interior of New Guinea. By Eric Mjöberg. *Illustrations and Sketch-map.*

New Zealand—Auckland and Campbell Islands. **Mortensen.**
G. Ts. 23 (1916) : 271-284.
Et Besøg paa Auckland- og Campbell-Øerne. Af Th. Mortensen. *Sketch-maps and Illustrations.*

Queensland—Hydrography. *Queensland G.J.* 30-31 (1914-1916) : 1-29. **Gregory.**
The flowing wells of Western Queensland. By J. W. Gregory. *Maps and Illustrations.*

Queensland—National Parks. *Queensland Q.J.* 30-31 (1614-1916) : 65-87. **Lahey.**
Some reasons why National Parks should be established in Queensland, with special reference to Lamington National Park. By R. W. Lahey. *Sketch-maps and Portrait.*

MATHEMATICAL GEOGRAPHY

Altitudes—Barometric. **Cordeiro.**
The Barometrical determination of heights. A practical method of barometrical levelling and hypsometry for surveyors and mountain climbers. By F. J. B. Cordeiro. New York and London: Spon & Chamberlain, 1917. Size 6½ × 4½, pp. 26.

Geodesy. **Buchwaldt.**
Geometrisk Bidrag til Geoidens Bestemmelse. Af F. A. Buchwaldt. Copenhagen, 1916. Size 11 × 9, pp. 85. *Illustrations.* [In Danish; French *résumé.*]

Map-reading.
Map-reading and panorama sketching. By an Instructor. 2nd edit., revised and enlarged. London: Sifton, Praed & Co., 1917. Size 7½ × 5½, pp. 114. *Maps, Plans, and Diagrams. Price* 4*s.* 6*d. Presented.*
The revision and enlargement of this little book, of which the first edition, published in August 1916, was exhausted within a year, makes it more valuable as a clear introduction to the subjects dealt with. It has been virtually rewritten, and contains several new illustrations.

Navigation—Tables. **Blackburne.**
Tables of calculated hour-angles and altitude-azimuth table, 30° N. to 30° S. Ex-meridian tables, 70° N. to 70° S. Calculated reductions and azimuths of 30 bright stars from 1 hour to 3 hours from meridian 64° N. to 60° S. By H. S. Blackburne. 2nd edit. London: J. D. Potter, [1917]. Size 10 × 6½, pp. lii. and 414. *Diagrams. Price* 10*s.* 6*d. Presented.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY

Geomorphology. **Dainelli and Marinelli.**
Mem. G. (*suppl. Riv. G. Italiana*) 10 (1916) : 289-316.
Materiali per lo studio delle forme di erosione. II. Sculture alveolari nelle arenarie ed in altre rocce. By Giotto Dainelli e Olinto Marinelli. *Illustrations.*

Terrestrial Magnetism. **Bauer and others.**

Researches of the Department of Terrestrial Magnetism. Vol. 3. Ocean magnetic observations 1905–1916 and reports on special researches. By L. A. Bauer and others. (Carnegie Institution Publication, No. 175.) Washington, 1917. Size 12 × 9, pp. viii. and 448. *Maps, Diagrams, and Illustrations. Presented.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Spurrell.**

Modern Man and his Forerunners. A short study of the human species living and extinct. By H. G. F. Spurrell. London: G. Bell & Sons, 1917. Size 8½ × 5½, pp. 190. *Sketch-maps and Illustrations. Price 7s. 6d. net. Presented.*

Commercial Geography. **Beltrán y Rózpide.**

Geografia: Guia y plan para su estudio con esp. aplicación á la geogr. económica. Ricardo Beltrán y Rózpide. *1a* parte: Preliminares—la Peninsula Española (pp. 147). *2a* pte.: Europa—Asia—Oceania (pp. 214). *3a* pte.: América—Africa—Tierras y mares Polares—El Mundo Terrestre (pp. 196). Madrid, 1915–1917. Size 6½ × 4½. *Presented.*

Ethnology. **Jackson.**

Shells as evidence of the migrations of early culture. By J. Wilfrid Jackson. London: Longmans, Green & Co., 1917. Size 8½ × 5½, pp. xxviii. and 216. *Illustrations. Price 7s. 6d. net. Presented.*

A new instalment of the researches inaugurated by Prof. Elliot Smith's 'Migrations of Early Culture' (reviewed in vol. 47, p. 461).

History of Cartography. **Anthiaume.**

Cartes Marines. Constructions navales. Voyages de découverte chez les Normands, 1500–1650. Par l'Abbé A. Anthiaume. Préface de l'Amiral Buchard. 2 vols. Paris: Ernest Dumont, 1916. Size 10 × 6½, pp. (vol. 1) xv. and 566; (vol. 2) 598. *Diagrams. Price 21s.*

GENERAL

British Empire. **Royal Commission.**

Dominions Royal Commission. Royal Commission on the natural resources, trade, and legislation of certain portions of H.M. Dominions. Papers laid before the Commission 1914–1917. London, 1917. Size 13 × 8½, pp. 48. *Price 6d. net.*

British Empire.

International Information Series. British Empire Section. Vol. 1: The resources of the Empire. By Dr. J. Watson Grice (pp. 64). Vol. 2: The defences of the Empire. By Archibald Hurd (pp. 64). Vol. 3: The Commonwealth of Australia, its development and resources. By Evans Lewin (pp. 64). Vol. 4: New Zealand. By G. H. Scholefield (pp. 64). London: G. Allen & Unwin, 1917. Size 8½ × 5½. *Price 1s. each. Presented.*

A useful series, giving much valuable information in a concise form.

British Empire—Dark Races. **Johnston.**

The Black man's part in the war. An account of the dark-skinned population of the British Empire. . . . By Sir Harry H. Johnston. London: Simpkin, Marshall & Co., 1917. Size 7½ × 5, pp. 128. *Illustrations. Price 1s. 6d. net. Presented.*

Education—Text-books. **Herbertson and others.**

The Oxford Geographies. Edited by A. J. Herbertson. The elementary geography. Vol. 7: The British Isles. By F. D. Herbertson. 2nd edit., revised by O. J. R. Howarth (pp. 192). A geography of Australasia. By Griffith Taylor. 3rd edit. revised (pp. 176). The junior geography, vol. 2. By A. J. Herbertson and R. L. Thompson. 7th edit., revised by O. J. R. Howarth (pp. 288). The senior geography. By A. J. and F. D. Herbertson. 5th edit., revised by O. J. R. Howarth (pp. 364). Oxford: Clarendon Press, 1917. Size 7½ × 5. *Maps and Illustrations. Price 1s. 9d., 1s. 6d., 2s., and 2s. 6d. Presented.*

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Horticultural & Agricultural
Plantation Cultivation
Productive Regions less highly developed (with 32-128 Inh. to 1 Sq. M.)
Agricultural & Pastoral
Plantation Cultivation & Agricultural
Less Productive or Undeveloped Regions.
Pastoral & Agricultural with 16-32 Inhabitants to 1 Sq. Mile
Forest & Primitive Cultivation with 16-32 Inhabitants to 1 Sq. Mile
Pastoral & Forest (Hunting & Fishing) with 1-16 Inhabitants to 1 Sq. Mile
Forest-(with 1-16 Inh. to 1 Sq. Mile)
Other Undeveloped Regions.
with less than 1 Inhabitant to 1 Square Mile.
Grassland, Steppe & Semi-Desert
Forest, Grassland, Steppe & Semi-Desert
Tundra, Alpine & Desert; incapable of Development
Desert & Alpine incapable of Development
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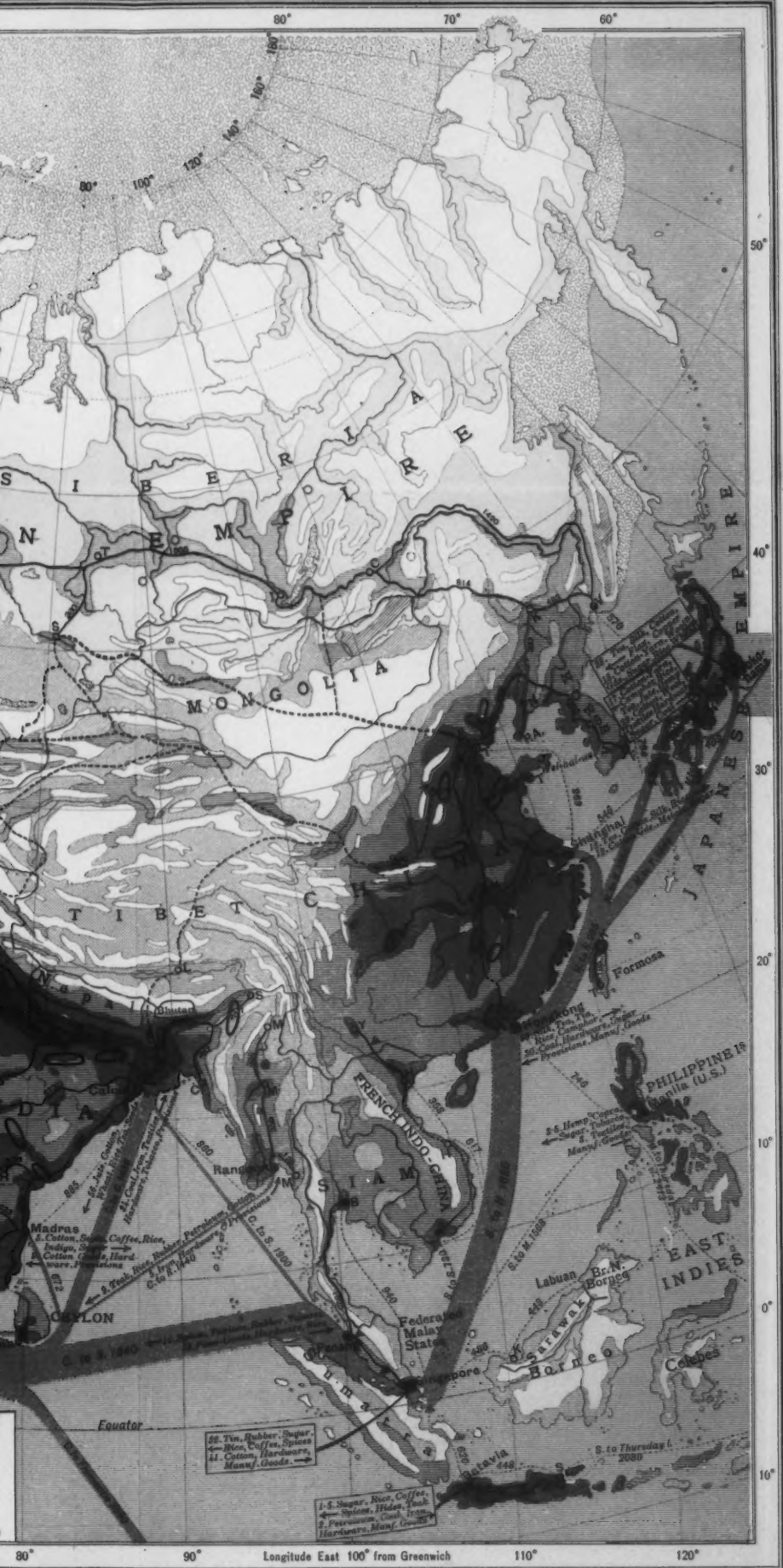

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